

Chronic Obstructive Pulmonary Disease (COPD)

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Contact hours: 3

Course price: \$19

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Course Summary

Chronic Obstructive Pulmonary Disease (COPD) is a chronic and incurable respiratory condition that has three categories: asthma, chronic bronchitis, and emphysema. This course covers these COPD topics: related statistics, anatomy and physiology of breathing, the various causes, risk factors, diagnosis and clinical symptoms, managing COPD, and major complications of COPD.

COI Support

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80% or higher on the post test, a completed evaluation form, and payment where required. No partial credit will be awarded.

Course Objectives

When you finish this course you will be able to:

1. Define Chronic Obstructive Pulmonary Disease.
2. Discuss the prevalence, incidence, and morbidity/mortality of COPD.
3. Explain how the A&P of breathing is affected by COPD.
4. List the major causes of COPD.
5. Identify common clinical symptoms of COPD and how it is diagnosed.
6. State the goals of COPD management and identify lifestyle and pharmaceutical interventions.
7. Discuss major complications of COPD and list prevention strategies.

Types of COPD

Mark is a 62-year-old white male who works in an auto assembly plant in Kentucky. He was seen in his primary physician's office reporting shortness of breath on exertion, fatigue, and dizziness for the past month. Mark has hypertension and has been on Lisinopril 10 mg tab once daily. His vital signs are 148/90, pulse 88, respirations 22, tympanic temperature 98.8, and SpO₂ 93.

Of note, he was short of breath walking into the clinic and smells of cigarette smoke. Upon physical exam, his heart sounds are audible without murmurs or dependent edema in his legs. He does have congested and tight lung sounds bilaterally with expiratory crackles. He has been smoking two packs of cigarettes daily for 20 years. With his smoking history and current clinical symptoms, what is the suspected diagnosis?

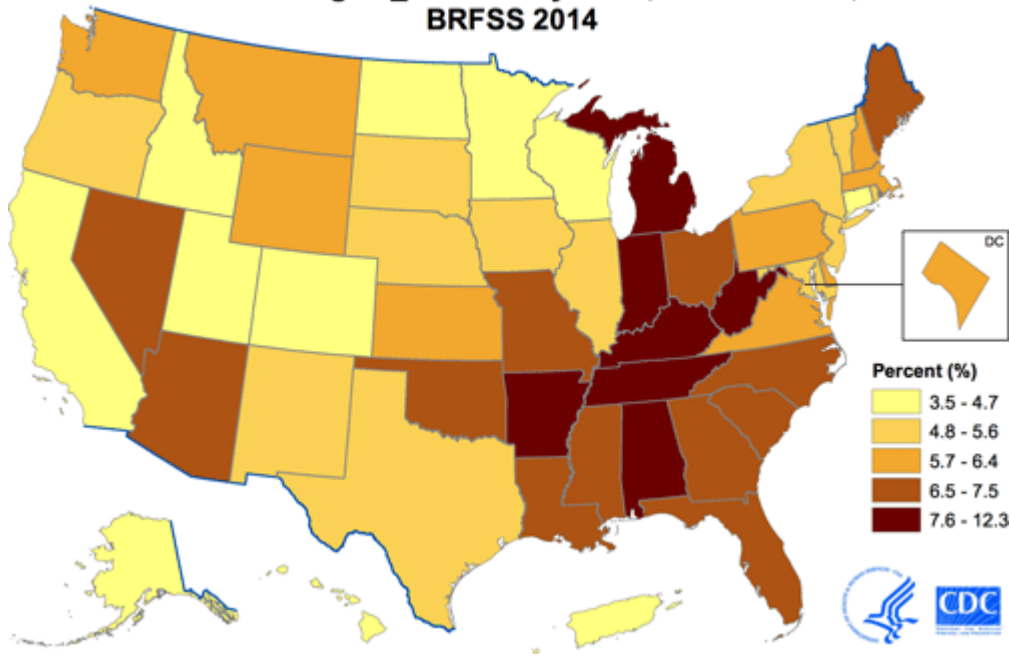
The scenario is unfortunately all too common for people with chronic obstructive pulmonary disease. As the healthcare professional, what would you do first? Is this a medical emergency? What diagnostic tests should be completed? What is the probable diagnosis? What were the patient's risk factors?

Prevalence of COPD

Chronic Obstructive Pulmonary Disease (COPD) is a group of chronic and irreversible respiratory diseases characterized by airway obstruction or restriction. It is not contagious or curable. COPD was the third leading cause of death in the United States in 2014 (NCHS, 2016). Correct diagnosis and management is important for quality of life and prevention of early death for approximately 26 million patients with COPD in the United States and, according to the Global Burden of Disease Study, 251 million cases of COPD globally in 2016 (NHLBI, 2012; WHO, 2018).

According to the Centers for Disease Control and Prevention (CDC), more than 143,000 U.S. adults die annually from COPD (CDC, 2015). The figure below shows age-adjusted prevalence of COPD among adults in the United States during 2014. The prevalence of COPD varies considerably by state, from <4% in Hawaii, Colorado, and Utah to >9% in Alabama, Tennessee, Kentucky, and West Virginia. The states with the highest COPD prevalence are clustered along the Ohio and lower Mississippi Rivers.

**Prevalence of Chronic Obstructive Pulmonary Disease (COPD)
for Adults Aged ≥ 18 Years by State, United States,
BRFSS 2014**



Data source: CDC Behavioral Risk Factor Surveillance System (BRFSS), 2014. COPD based on an affirmative response to the question, "Has a doctor, nurse or other health professional ever told you that you have COPD, emphysema, or chronic bronchitis?" Prevalence age-adjusted to the 2000 US standard population. Source: CDC, 2015.

Types of COPD

COPD is characterized by inflammation of the airways and severe air flow restriction both in and out of the lungs. *COPD* is an umbrella term that includes chronic bronchitis, emphysema, and asthma. Some people may have combinations of COPD and emphysema or COPD and chronic bronchitis. It is generally caused by long-term exposure to environmental irritants such as cigarette smoke, second-hand smoke, air pollution, fumes, and wood smoke.

Although the overall term for each of these diseases is COPD, clinicians refer to COPD as a *specific disease process*, most commonly seen among long-term cigarette smokers with chronic airway obstruction from inflammation. COPD can also be further described as *obstructive* or *restrictive*.

A key characteristic with any type of COPD is limited airflow, which results in hypoxia and carbon dioxide retention. The person who has COPD doesn't have full ability to exhale as alveoli lose elasticity, resulting in poor exchange of oxygen and carbon dioxide. As a result, the alveoli often overinflate and the chest becomes expanded with retention of carbon dioxide.

Emphysema

Emphysema is a type of COPD that shares the clinical symptoms of shortness of breath and airway obstruction. Commonly seen in people with a long-term history of smoking, it is noted uniquely in the clinical presentation as a **"pink puffer."** The term comes from the clinical appearance of patients with emphysema, who, with the increased work of breathing, have a flushed appearance from lack of oxygen and poor cardiac output. The damage is deep within the lungs, arising from overinflated alveoli where air has become trapped because of the inability to exhale the carbon dioxide.

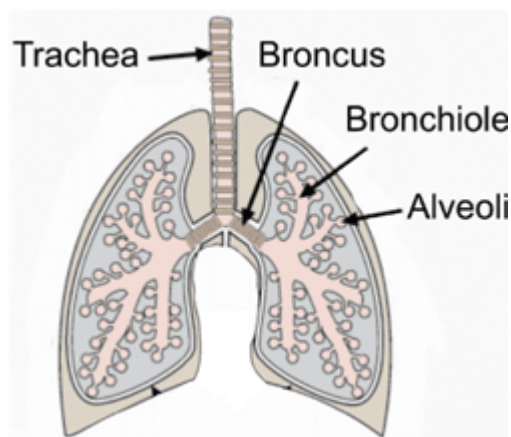
Chronic smoking damages the flexibility of the alveoli, making them stiff and ineffective. Originally small air sacs, alveoli become stretched and floppy and thus less effective in moving oxygen into and out of the capillaries. Often because the work of breathing takes all their energy, people with COPD become exhausted while eating, so they experience weight loss as well as muscle wasting due to the lack of oxygen. Emphysema has also been called "COPD Type A."

The data on emphysema indicate that 90% of cases are seen in people over the age of 45 (ALA, 2017). Rates of diagnosis have been increasing among women, showing trends of COPD now equalizing among women and men.

Chronic Bronchitis

Chronic bronchitis is a type of COPD characterized by inflammation, airway irritation, and mucus buildup in the main bronchus. The clinical diagnosis is defined as “persistent cough that produces phlegm and mucus, for at least 2 months per year, in 2 consecutive years” (ALA, 2017). Symptoms include chronic cough that attempts to rid the airway of thick mucus and phlegm. There are two types of bronchitis, acute and chronic. **Acute bronchitis** is generally caused by colds and flu. The temporary infection causes inflammation, with irritation to the bronchus and bronchioles, and results in coughing and shortness of breath.

Women have chronic bronchitis at twice the rate of men (Pietrangelo, 2015). Age increases the risk for COPD, as people over age 65 have a rate of 64.2 per 1,000 persons compared to the age group of 18 to 44 in which the rate drops to 28 per 1,000 (ALA, 2017). Prevalence trends also reveal that non-Hispanic whites have a higher risk than African American blacks and Hispanics.



Source: Intechopen.com

Chronic bronchitis is also characterized by cough; however it does not go away with antibiotics or treatment because it is caused by smoking or other environmental pollutants such as dust, air pollution, or unsafe work environments where coal, asbestos, or other irritants inflame delicate respiratory tissues. Although acute bronchitis can be remediated with pharmacologic interventions and time for healing, there is no cure for chronic bronchitis. Treatment is focused on relief from annoying cough symptoms and supporting the airway. Bronchodilators are the mainstay of therapy.

Asthma

Asthma and COPD may result in the same air flow resistance, but whereas the cause of COPD is generally smoking, asthma is caused by other respiratory irritants such as air pollution or environmental triggers like dust, molds, pet dander, and more. Asthma is a form of COPD characterized by spasms of the bronchi in the lungs leading to an overreaction and spasm of the bronchial airways. Normally the bronchiole tubes dilate and constrict depending on nervous system messages; however, in asthma the bronchus and bronchiole tubes constrict and overreact to environmental and even emotional triggers, causing severe difficulty with breathing and airflow.

Asthma is characterized by wheezing from a restricted air flow, chest tightness, and increased mucus from the inflamed airways, which worsens the restriction and impedes air flow. Unlike emphysema, which is seen in older patients with a history of years of smoking, asthma is seen in people of all ages and often first manifests during childhood.

When asthma develops in young children, it may often resolve on its own as the child's respiratory system develops and matures. Other children may continue to suffer from asthma for the rest of their lives and require maintenance medications to keep the airways open.

There has been a correlation between asthma and eczema, indicating an autoimmune response. Combinations of eczema (atopic dermatitis) and allergic rhinitis indicate a risk for developing other allergies and asthma as **immunoglobulins** (antibodies) respond to the allergen. A body defense to high levels of immunoglobulins is to close the airways in order to prevent the invading pathogen from further entering into the body.

In the case of asthma, this natural defense mechanism becomes the problem, as airways spasm and even threaten to close. For many children with asthma, there is a genetic link to a deficiency of a protein in the skin, which normally helps strengthen the skin from pathogens and allergens. Without the protein, the skin is more irritated by environmental allergens and microbes and the body responds quickly with hives, eczema, and the resulting antibodies (AAAAI, 2016).

Asthma affects 25 million people in the United States and is the most common chronic disease of childhood. As high as 95% of patients with asthma also suffer from chronic rhinitis (Glass, 2014).

Case Review

In our earlier scenario, the diagnosis of COPD was determined. What symptoms did he present with and what were his risk factors? What were the triggers that caused the COPD? What type of COPD does he have?

Online Resource

[Video \(3:56\): Chronic Bronchitis](#)

Test Your Knowledge

What conditions are included in the definition of COPD?

- A. Asthma, emphysema, and acute bronchitis
- B. Asthma, chronic bronchitis, and emphysema
- C. Asthma, pneumonia, and acute bronchitis
- D. Emphysema, chronic bronchitis and cystic fibrosis

Answer: B

Statistics About COPD

COPD develops over time and is an obstructive or restrictive expiratory airway due to chronic bronchitis, emphysema or asthma (Glass, 2014). Chronic obstructive pulmonary disease is the third leading cause of death (following cardiovascular disease and cancer) for most racial and ethnic groups in the United States (Mozaffarian, 2015) and is largely irreversible and fatal (CDC, 2018). It is projected that, with increasing prevalence of smoking in developing countries and aging populations, the prevalence of COPD will rise over the next 30 years.

Prevalence

Prevalence indicates how many people currently have the disease, and approximately 1 of every 13 Americans aged 18 years and older has COPD. Data is collected annually from two major surveys including the National Health Interview Survey (NHIS) and the Behavioral Risk Factor Surveillance System (BRFSS). In the United States, COPD is most common among Caucasians and those with a history of smoking.

Approximately 26 million Americans have been diagnosed with COPD and many more are thought to be as yet undiagnosed. It is seen more in men and women older than 40 years of age, and is often due to years of chronic smoking. It is more common in men than women, but rates of COPD among women increase as women smoke. It is estimated from previous studies that 8% of U.S. adults have been told by a healthcare provider that they have COPD (Kosacz, 2012; CDC, 2013; NCHS, 2016).

Incidence

Incidence tells how many new cases are diagnosed each year. The incidence and prevalence of COPD vary by state (see earlier map) and worldwide statistics are unknown because more than 50% of people formally diagnosed with low pulmonary function were not even aware of it (CDC, 2015; Wheaton, et al., 2013). According to the World Health Organization (WHO), approximately 65 million people have some form of COPD; however, much of the data on morbidity and mortality from COPD come from first-world countries. Incidence is estimated to be approximately 5% of all deaths worldwide (WHO, 2018). States with higher rates of smokers show a direct correlation to a higher incidence of COPD.

Morbidity and Mortality

[Material in this section is from Pietrangelo, 2015 unless otherwise cited.]

Morbidity is the term for the cost and consequences of a disease. Illness from COPD has a large impact on the American health system. According to CDC estimates, COPD costs our country approximately \$50 billion annually in both direct and indirect health care (CDC, 2012). The cost of COPD for people over age 65 has increased to almost \$30 billion in direct healthcare costs and another \$20 billion in direct mortality and morbidity costs.

Additional costs include loss of work and ability to function; 51% state their ability to function at work is limited and 70% claim COPD limits their physical ability. Social and family activities are also limited because patients with COPD have difficulty walking, participating in leisure activities they once enjoyed, and even performing activities of daily living (ADLs) on their own.

Mortality is the statistic for actual deaths caused by a disease. In 2009, according to the American Lung Association, for 133,965 people COPD was the cause of death. One year later, 134,676 died from COPD—711 more deaths despite vigorous smoking cessation campaigns. More than half (52%) were in women; in the past, COPD had been higher among men but with cigarette smoking now equal between the genders, so also is the consequence of COPD.

Ethnicity reveals that 80% of COPD deaths are in non-Hispanic whites, and Hispanics had the least number of deaths (only 3,714 out of 133,965). African Americans had 7,539 deaths from COPD. Caucasians are at 3 times greater risk than Hispanics or African Americans to smoke and therefore die of COPD. Statistically, approximately 41 people out of 100,000 people die annually from COPD.

A correlation with rates of COPD is seen in states that have the highest smoking populations, notably the southeastern and midwestern states. Thirty-one percent of cases of COPD are attributable to environmental insults other than smoking; these include industrial pollutants—in factory workers who have never smoked and in developing countries. In disadvantaged homes, COPD may correlate with cooking using fossil fuels instead of electricity.

Survival rates are bleak. Female smokers are 13 times more likely to die from COPD than non-smoker females, and male smokers are at 12 times greater risk to die from COPD than counterpart non-smoking males.

Mark, the 62-year-old white male in our original case, is given the diagnosis of COPD and asks his healthcare provider how he developed it, whether there is a cure, and what is his prognosis. The provider tells him that his 20-year history of smoking, which equals 40 pack years* (20 years times 2 packs/day= 40), is the main cause of his COPD. He has additional risk factors of being a white male and working with industrial pollutants in his job. Unfortunately, there is no cure for him but he can receive treatment for the symptoms. His prognosis depends on his ability to stop smoking. The reality is that he has increased his morbidity by 12 times by choosing to smoke. The provider then explains how his lungs function and discusses treatment options.

***Pack years.** Number of packs per day times the number of years smoked.

Test Your Learning

In the United States, which statistic about COPD is true?

- A. One in three people have COPD.
- B. Women are more at risk of COPD than men.
- C. COPD is the third leading cause of death.
- D. Hispanics and African Americans are at the same risk of developing COPD.

Who is at greatest risk for developing COPD?

- A. A 50-year old woman who smoked 1 pack daily for 30 years.
- B. A 70-year old man whose wife smokes outdoors only.
- C. A 63-year old woman who has never smoked but works in an industrial company as a secretary.
- D. A 50-year old man who smoked 2 packs of cigarettes per day for 25 years.

Apply Your Knowledge

State a patient profile of a person who would be at greatest risk for developing COPD.
What risk factors contribute to morbidity and mortality of COPD?

Answers: C, D

Anatomy and Physiology of Breathing

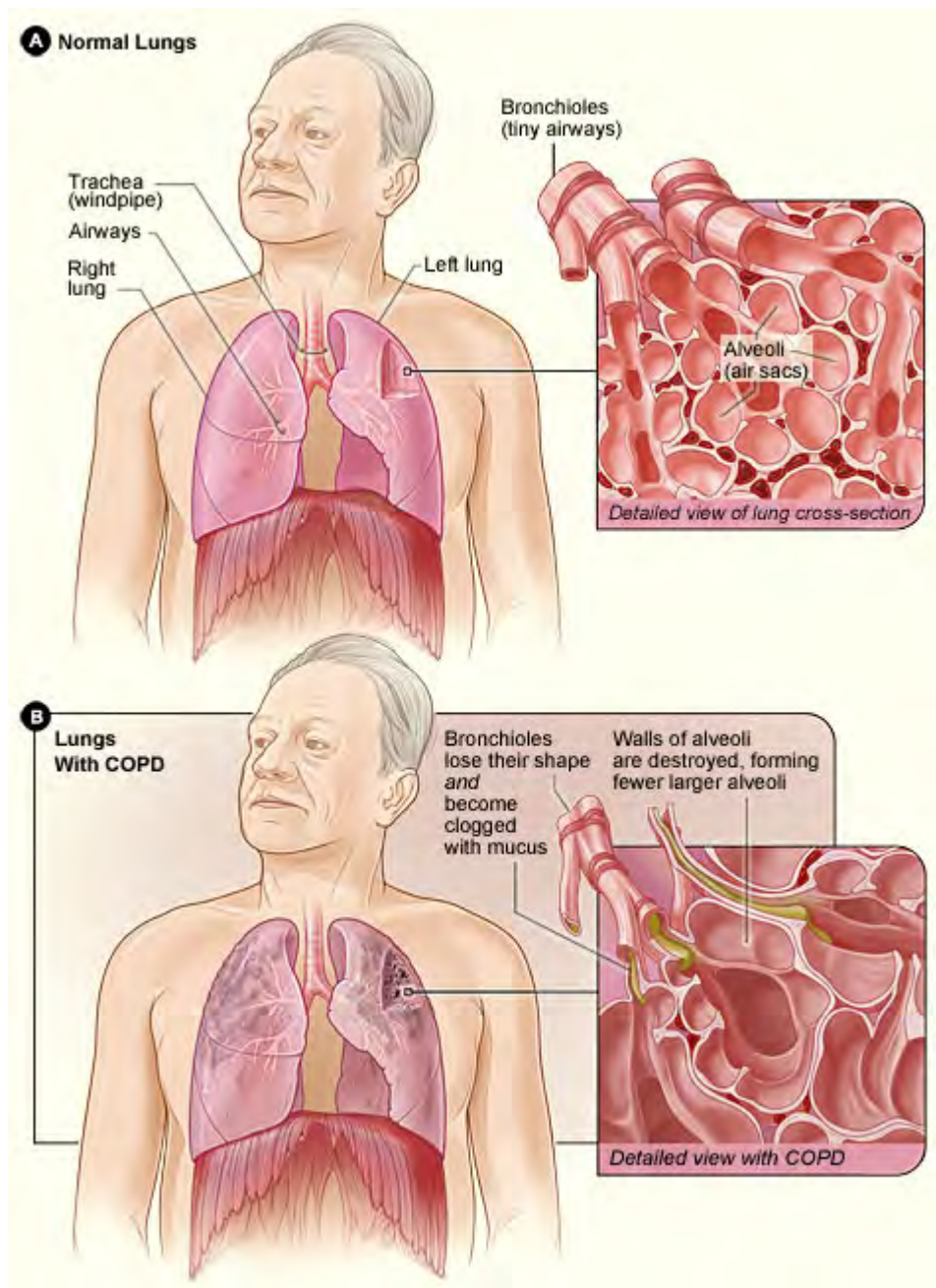
It is important to understand the normal anatomy and physiology of breathing in order to identify the causes and results of COPD. Understanding the pathophysiology of ventilation will also help you understand the mechanisms of action of the pharmacologic interventions designed to open the airways.

Anatomy of the Lungs

The respiratory system is divided into the upper airway and the lower airway. The upper airway includes the nose, nasal and oral pharynx, epiglottis, and larynx (also known as the “voice box” or “Adam’s apple”). Below the larynx is the lower airway, consisting of the trachea, bronchus, and bronchiole tubes, which further divide like branches of a tree into smaller bronchioles and then end with small air sacs called **alveoli**.

The human body has two lungs in the thoracic cavity; there are two lobes on the left, with a border to fit the heart, and three lobes on the right side of the chest. The diaphragm divides the thoracic cavity from the abdominal cavity and is the primary muscle of respiration. Accessory muscles that help open the thoracic cavity include the internal and external intercostals of the ribs plus the abdominal muscles. When the diaphragm contracts it pulls the lungs downward, enlarging the thoracic cavity and allowing the lungs to expand and draw in air through the mouth and nose, down the trachea, larynx, and bronchi.

At the alveolar level, **capillaries**, the smallest vessel that connects arteries and veins, surround the alveoli and exchange oxygen for carbon dioxide. When the bronchioles and alveoli become constricted, full of mucus and less able to expand and dilate, air becomes trapped and gases are not exchanged. This creates a pressure that can make the lungs stiff and unpliant, causing the resultant barrel chest seen in many patients with COPD.



Source: Wikimedia Commons.

Physiology of Breathing

The internal pressure in the thoracic cavity is negative compared to the positive atmospheric (air) pressure. When the diaphragm contracts it opens up the thoracic cavity, allowing air to rush into the bronchioles and fill the alveoli. When the pressure within the lungs exceeds the external pressure by filling to capacity with air, the reverse occurs. The diaphragm relaxes and air is pushed out of the lungs in an exhale. COPD alters this effective function. Because the diaphragm does 80% of breathing, when the alveoli trap air, the diaphragm becomes flattened and ineffective in pulling the thoracic cavity open, which further reduces the incoming air flow.

The tissue of the bronchiole tubes contain two major receptors for the nervous system—the muscarinic and beta receptors. **Muscarinic receptors** cause smooth-muscle contraction, making the lumen (opening) of the bronchiole tube smaller. In contrast, the **beta receptors** cause relaxation of the muscle and thus bronchodilation. Ideally, the goal for people with COPD is to increase beta receptor activity (dilation of airways) and inhibit muscarinic receptors. The two main classes of medications act on these receptors. Because people with COPD also have inflammation of the airways, a third major pharmacologic mechanism to change this cycle of airway over-reactivity is an anti-inflammatory such as inhaled corticosteroids.

Obstructive and Restrictive Lung Disease

COPD results when there is a chronic obstruction or restriction of full air flow. The **obstruction** is generally mucus, whereas the **restriction** is the narrowing of the bronchioles or alveoli. Asthma often results in a restrictive airway as environmental triggers create a spasm of the bronchioles resulting in bronchoconstriction.

COPD is caused by a bronchoconstriction and inflammation, making air passage in and out of the lungs more difficult. This reduction in effective air flow creates a state of hypoxia, resulting in hypoxemia. As noted earlier, chronic bronchitis is a chronic productive cough lasting 3 months during 2 consecutive years. Emphysema is a permanent enlargement of the alveoli, which prevents normal elastic recoil during respiration.

People with asthma develop an obstruction of the airway and air flow. Those with asthma who have a reversible air flow obstruction are not considered to have COPD; however, when the air flow remains chronically obstructed, and is not reversible, they are diagnosed with COPD (Jarvis, 2015).

The lungs become scarred from chronic inflammation and irritation caused by mucus buildup as the lungs attempt to protect themselves from environmental irritants such as smoke. This cycle of irritation, inflammation, and attempts at recovery continue until the compensation efforts create disruptive symptoms that drive the patient to seek medical care. A productive cough with mucus is an effort of the lungs and trachea to rid themselves of the irritant; however, the mucus may soon become a problem in itself, and is sometimes known as a “smoker’s cough.”

Effects of Smoking

[Material in this section is from smokefree.gov 2018 unless otherwise cited.]

Smoking, the number one cause of COPD, destroys the cilia (fine hairs) in the bronchiole tubes and trachea that are supposed to push foreign substances and pathogens from the lower airway into the upper airway so they can be expelled by a cough. Pathology from smoking affects not only the lungs but also the circulatory system (Glass, 2014). Nicotine paralyzes the cilia, and the tar within cigarettes or cigars further destroys their integrity.

Additionally, the chemicals in cigarette smoke create nicks within the fine endothelial lining of the arteries throughout the body, leaving places for cholesterol and fat to build up. Generally, the public is aware of cigarette smoking as the most common cause of lung cancer; however, most people are unaware of the damage to the circulatory system, which is also the most common cause of **atherosclerosis**, or narrowing of the arteries.

Further, nicotine competes with oxygen in the formation of new red blood cells, which can lead the blood to become thick and sticky, forming atherosclerotic plaques that narrow arteries and hinder blood flow. The surface of a bulging atherosclerotic plaque sometimes tears, exposing material that stimulates clot formation. Clots and ruptured plaque material can then break away from the wall, be carried by the blood, and clog arteries downstream.

Atherosclerosis can damage tissues throughout the body:

- Blockages in the carotid arteries can reduce or block blood flow to the brain, causing a stroke.
- Obstructions in the peripheral arteries in the legs can cause claudication (pain when walking) gangrene, and deep vein thrombosis (DVT).
- Resultant DVTs can travel to the lungs, causing a pulmonary embolism and respiratory arrest.
- Atherosclerotic obstructions in the intestines cause ischemic bowel.
- In the coronary arteries, atherosclerotic obstructions cause heart attacks. (NHLBI, 2016)

Smoking affects each body system as it reduces the oxygen supply to tissues and cells. Within the brain it becomes an addictive substance, as strong as heroin. Nicotine and tar reduce the oxygen supply to the cochlea of the inner ear, causing hearing loss, and retinas of the eyes, which may lead to macular degeneration and blindness. The loss of skin elasticity due to smoking can lead to accelerated wrinkles, dull skin tone, and dryness.

At the cellular level, DNA is disrupted by the nicotine and tars from smoking, which can lead to uncontrolled mutations in cellular replication known as cancer. One-third of all cancer deaths are caused by tobacco and smoking. Cancers of the mouth and throat are caused by smoking. In addition to disruptions in normal DNA creation of proteins, hormones disruptions result in lowered estrogen and testosterone levels, thyroid problems, and reproduction issues.

Within the circulatory system, both white and red blood cell counts stay elevated in smokers. High white blood cell counts indicate that the body is in a state of infection, a continuing cycle of inflammation with attempts to repair itself. Overproduction of red blood cells in the bone marrow places stress on other body systems. In the skeletal system there is a higher risk for osteoporosis (loss of bone density), which can lead to fractures. Muscle pains and weakness are more common among smokers than non-smokers. Healing bones, muscles, and skin take much longer without adequate oxygen.

Although electronic cigarettes (“vapes”) may eliminate the tars found in traditional cigarettes and cigars, their nicotine still causes detrimental effects on each of the body systems. The FDA has not approved electronic cigarettes for a smoking cessation strategy due to the similar adverse effects of nicotine.

In addition to the nicotine, manufacturers have added heavy metals and other debris, chemicals, fuels, and flavorings (including formaldehyde, used in embalming a corpse) to their products with each of their own adverse effects on the body.

According to Stanton Glantz, who directs the UCSF Center for Tobacco Control Research and Education,

E-cigarettes are widely promoted as a smoking cessation aid but for most people they actually make it harder to quit smoking; so, most people end up as so-called dual users who keep smoking while using e-cigarettes. The new study shows that the risks compound. Someone who continues to smoke daily while using e-cigarettes daily has an increased risk of a heart attack by a factor of five. (LaMotte & Scutti, 2018)

Alveoli of Smoker and Non-Smoker



Upper right: This image shows the clear pink alveoli of a non-smoker without COPD; lower right: this image reveals the hyperinflation and clogging of the alveoli from COPD, which makes gas exchange much less effective.

Source: Wikimedia Commons.

Mark has discovered that the result of 20 years of smoking has compromised his lungs' ability to inhale and exhale. Unfortunately, his symptoms of shortness of breath and persistent cough were his only indicators. Mark's provider will order additional diagnostic studies to confirm the diagnosis, including a spirometry, lab tests to establish a baseline, and a chest x-ray.

Test Your Learning

What is the pathology of COPD within the bronchioles?

- A. The bronchioles are not affected, but the alveoli become hyperinflated.
- B. The bronchioles become constricted and often are full of mucus.
- C. The bronchioles become expanded and the alveoli constrict.
- D. The cilia within the trachea become elongated to compensate for the closing airways.

Apply Your Knowledge

What can you teach people who smoke about the effects of smoking on their lungs and arteries?

Answer: B

Causes of COPD

COPD is generally caused by long-term exposure from environmental irritants such as smoke (including second-hand smoke), air pollution, fumes, and wood smoke. A rare cause can be from a deficiency in alpha-1 antitrypsin; without the enzyme, the body is not able to break down mucus, which leads to thick mucus building up in patients with COPD from smoking.

Causes of Emphysema

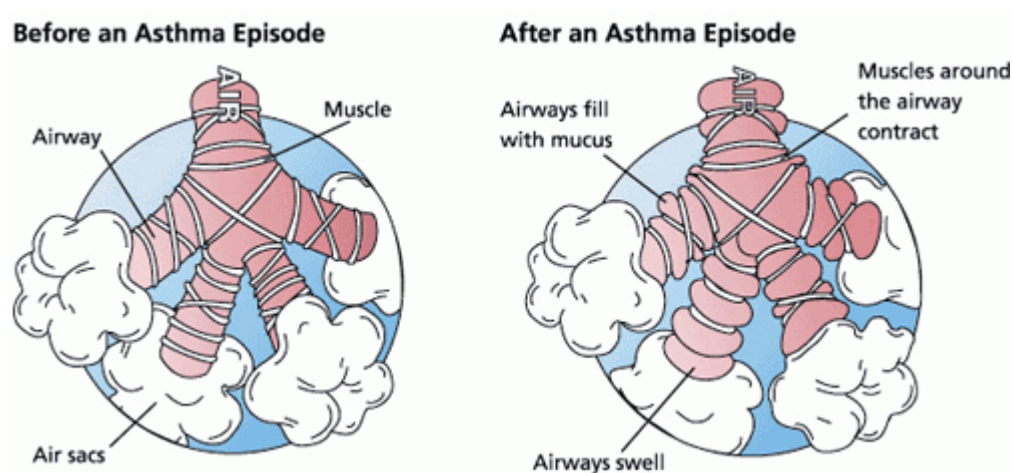
Cigarette smoking is the primary cause of all types of COPD, and emphysema is caused by long-term environmental exposures. The difference between general COPD and emphysema or bronchitis is the over-inflation and stiffening of the lungs with emphysema, making gas exchange difficult.

Causes of Asthma

Asthma can be triggered by environmental factors that cause the airways to constrict. Why do some people respond to certain environmental irritants and others do not? Genetic studies are looking at autoimmune genetic differences. The exact cause of these differences is not yet known but studies do point to variations in the genetic code.

There are two types of asthma, intermittent and persistent. **Intermittent asthma** can be caused by an occasional allergic reaction to an environmental or emotional trigger, with constriction of the airways for up to two days a week. **Persistent asthma** becomes uncontrolled without medication. Classic causes of asthma include dust, pollutants, strenuous exercise, and even emotional stress, to all of which the body responds by closing off the airways, which leads to an asthma attack.

The hyperreactivity of the airways in asthma generally progress to bronchoconstriction, airway wall edema, chronic mucus plug formation, and chronic airway remodeling (Glass, 2014).



Source: Wikimedia Commons.

Causes of Chronic Bronchitis

Bronchitis is a type of COPD caused by mucus retention in the lungs and bronchial passageways due to chronic irritation and inflammation.

The cause of acute bronchitis is generally viral or bacterial; however, the cause of **chronic bronchitis** is a chronic irritant. It is characterized by persistent productive cough and is generally due to smoking. For those non-smokers who develop chronic bronchitis, the cause may be from air pollution, dust, or other environmental triggers. Those with autoimmune diseases may also experience hypersensitivity to triggers. Whereas acute bronchitis may be cured by being treated with antibiotics and cough suppressants, chronic bronchitis has no cure but can be managed with medications.

Risk Factors

As noted earlier, smoking, pollutants, and genetics all play a role in the development of COPD. Smoking is the #1 controllable risk factor for COPD and much attention and effort should be placed on helping people to stop smoking. It is the first intervention a healthcare professional should initiate for a patient with smoking-caused COPD.

Other air pollutants are more difficult as they may not be within someone's choice or ability, such as those who live in polluted cities, or work in industrial environments with poor air quality. In Asia it is now quite common to see people walking the streets and taking trains and buses wearing simple air filter masks.

Non-controllable risk factors include genetic mutations or autoimmune diseases that react in a hypersensitive or allergic way.

Identifying Patients at Risk

A valid and costly concern for health maintenance organizations (HMOs) and insurance companies is that numerous patients are hospitalized for acute exacerbations of their COPD, which could have been avoided by careful management by their primary physician. A hospitalization from a COPD exacerbation can cost thousands of dollars. The national guidelines and the GOLD standard* for COPD diagnosis and management were created based on numerous clinical studies. It has been adopted by HEDIS** for insurance reimbursement and by the Center for Medicare Services (CMS).

*The Global Initiative for Chronic Obstructive Lung Disease (GOLD) works with healthcare professionals and public health officials to raise awareness of Chronic Obstructive Pulmonary Disease (COPD) and to improve prevention and treatment of this lung disease for patients around the world.

**The Healthcare Effectiveness Data and Information Set (HEDIS) is a tool used by more than 90 percent of America's health plans to measure performance on important dimensions of care and service. Altogether, HEDIS consists of 94 measures across 7 domains of care.

By surveying and tracking reports of people with COPD across all states, improvements can be made in identifying communities at risk who may benefit from awareness, outreach, and public health efforts in prevention, treatment, and control of the disease. Efforts to survey patients with COPD in all states has been done by the Centers for Disease Control using the Behavioral Risk Factor Surveillance System (BRFSS) (CDC, 2012). Of those who self-identified as COPD, 76% stated they received a diagnostic breathing test, 64% felt the shortness of breath negatively impacted their quality of life, and 55% were taking at least one medication for their COPD (Kosacz, 2012). Because the spirometry test can be costly, it is not used as a general screening tool for COPD; currently there is no general public screening tool in use.

Predisposing factors include the environmental pollutants and also include secondhand smoke, genetic factor of alpha-1 antitrypsin (AAT) deficiency, recurrent or chronic lower respiratory infections, or disease and age over the fifth decade of life.

Apply Your Learning

Picture your own patients who have COPD, emphysema, chronic bronchitis, and asthma. How are they the same? How are they different? What similarities in medications do they receive? What interventions applied for each?

Resource

YouTube (3:59): Reducing the Risk of COPD

<https://www.youtube.com/watch?v=4fEiZ64q-J8>

Test Your Learning

Which one is a cause of all three types of COPD?

- A. Inflammation and environmental triggers
- B. Cigarette smoking
- C. Industrial pollutants
- D. Genetic mutations in mucus production

Answer: A

Symptoms of COPD

Most symptoms of COPD are due to obstruction or restriction to air flow in and out of the lungs, leading to difficulty in breathing. Dizziness, fatigue, shortness of breath, and even hypertension are all related to hypoxia, a lack of adequate oxygenation in body tissues. As in any condition, a thorough history is a necessity. It is said that as many as 9 out of 10 diagnoses can be determined by a good history.

Asthma

A history of difficulty breathing, shortness of breath after exercise, or exposure to environmental triggers can help identify the development of asthma. Clinical symptoms include wheezing, recurrent cough (worse at night and early morning), recurrent shortness of breath, and chest tightness with moderate activity.

Pectus Excavatum (Pigeon Chest)

Upon physical exam of those with childhood asthma and chronic respiratory illness, such as emphysema, the anterior thorax may appear pigeon-shaped or retracted. With a constant struggle to breathe, the accessory muscles (internal and external intercostals) and abdominal muscles are forced to engage and often pull the chest inward, resulting in pectus excavatum (pigeon chest).

Chronic Bronchitis

The diagnosis of chronic bronchitis is made initially with the reported symptoms of a persistent productive cough for at least 2 consecutive months within 2 years. A history of cough, lack of energy, and chest irritation can begin the questioning of types and causes of cough. A clinical symptom is worsening cough with white or yellow sputum that has become more viscous. Rhonchi (rattling) in the chest, wheezing, rapid respirations, fatigue, headache, loss of appetite, fever, myalgias, and arthralgias are commonly seen.



Source: Wikimedia Commons.

Emphysema

Symptoms for emphysema are similar to chronic bronchitis but with gradual exertional dyspnea and weight loss. Because of the difficulty breathing, caloric expenditure is increased, causing weight loss; in addition, there can be a lack of appetite that focuses on breathing rather than cooking, chewing, and eating. Flushed skin, barrel chest (increased anterior to posterior chest diameter), clubbed fingers, decreased libido, thin wasted appearance, and wheezing during exertion are classic. This is the classic “pink puffer.”

Diagnosis and Evaluation of COPD

As noted earlier, diagnosis begins by taking a thorough medical history, including exposures to environmental pollutants and resultant symptoms. Review of the subjective data in a history asks about onset, duration, course of symptoms, food patterns, smoking, and medications. A thorough history is helpful by asking the OLDCARTS* questions and including questions about smoking history, other diseases such as asthma, and alleviating and aggravating factors. For a physical exam, in addition to the standard vital signs, a focused assessment should be done on the lungs and breathing pattern, and adventitious sounds (Glass, 2014). An examination of sputum should observe for pink froth (seen in pulmonary edema) or presence of blood (possible TB).

*For those who favor mnemonics, the eight dimensions of a medical problem can be easily recalled using OLDCARTS (onset, location/radiation, duration, character, aggravating factors, relieving factors, timing and severity).

Conduct a general inspection that includes skin color, amount of respiratory effort, and an increase in anterior-posterior (AP) chest diameter. A 2:1 AP ratio is often seen in COPD. Advanced disease may show distended neck veins, whereas an early case of COPD may show very few clinical signs. The lungs should be assessed for absence of ventricular sounds found in COPD and increased vocal **fremitus** (vibration) and **egophony** (resonance) due to air trapping. Pallor, cyanosis, and decreased orientation may reveal hypoxia.

Spirometry is the gold standard for diagnosing COPD and pulmonary function tests; it easily performed in a clinical setting and should be done as a baseline for diagnosis and management of the disease. It should be done before and after a bronchodilator to determine improvement and diagnosis of FEV1. The ratio of FEV1 and FVC of less than 0.70 is diagnostically positive for COPD. ABGs, EKG, echocardiogram, TB test, and chest CT may reveal other causative factors.

Diagnostic Features

The classic symptom of COPD is shortness of breath. At first, there may be little to no symptoms with COPD; however, because it is a chronic and progressive disease of deteriorating lung capacity and air flow, symptoms inevitably develop and worsen. Wheezing, shortness of breath, chest tightness, and cough are classic symptoms that also lead to weight loss, muscle loss, and difficulty with daily activities.

Symptoms of COPD

Early Symptoms

- Daily morning cough
- Shortness of breath—especially on exertion
- Wheezing

Moderate Symptoms

- Ongoing productive cough
- Chest tightness
- Fatigue
- Loss of appetite if breathing through the mouth
- Sputum—clear and colorless, may be frothy
- Change in mental alertness
- Weakness

Late-Stage, Severe Symptoms

- Dizziness
- Pallor
- Cyanosis
- Chronic cough throughout day (smoker's cough)
- Waking up feeling suffocated
- Blue lips, skin, and nails
- Inability to lie down
- Irritability and headaches
- Difficulty sleeping

Here is a mnemonic to help you remember the symptoms of COPD:

- L** Lack of energy
- U** Unable to tolerate activity
- N** Nutritional deficit
- G** Gas abnormality (respiratory acidosis)

- D** Dry or productive cough
- A** Accessory muscle use and abnormal lung sounds
- M** Modification of skin color
- A** Anterior/posterior diameter increase
- G** Gets in tripod breathing position
- E** Extreme dyspnea

Quality: From Mild to Severe

The quality of shortness of breath varies from mild to severe. **Mild** is seen in the initial stages of COPD and is common upon exertion, which limits activities of daily living; whereas, **severe** shortness of breath and symptoms cause the work of breathing to occupy all thoughts and energy.

Because asthma is classified in four ways,

- step 1: mild intermittent,
- step 2: mild persistent,
- step 3: moderate persistent,
- step 4: severe persistent

the quality of cough and shortness of breath must be determined from mild to severe and quantified by how many days per week the patient is in distress breathing.

Triggers: Exercise

COPD can be triggered by exercise as well as allergies and pollutants. Determining the type of trigger is essential in asthma to teach prevention of acute exacerbations and better prophylaxis.

Occurrence: Predictable or Unpredictable

The use of a home peak-flow meter should be used to help identify the current condition of the lungs and airways. Acute exacerbations can be better understood by identifying whether the acute event was predictable—such as poor weather conditions, air quality, or exercise—or unpredictable. Here are symptoms to investigate further:

Wheezing

- There are 741 causes of wheezing and COPD is only one cause.
- Identify the characteristics of the wheezing.
- Identify the time of day and activities when wheezing starts and stops.

Chronic Cough

- How long have you had the cough?
- How do you describe the cough?
- Is it productive or dry?
- Is it only in the morning or throughout the day?
- What time of day is the cough worse?
- Is the cough related to meals?
- What environmental exposures are you around?

Sputum

- What color is the sputum?
- What is the consistency: clear, frothy, pink, thick, thin?
- When is sputum worse during the day?

Breathing Difficulties

- Do you have trouble breathing in or out or both?
- How fast are you breathing?
- Do you use oxygen?

Cyanosis

- What is blue: skin, nails, face, lips?

Irritability/Headache

- What is the nature of the headache?
- What makes the headache worse or better?

Apply Your Learning

What are the classic clinical symptoms of asthma, chronic bronchitis, and emphysema?

Test Your Learning

Which of the following is **not** a symptom of COPD?

- A. shortness of breath on exertion
- B. tachypnea
- C. wheezing and adventitious lung sounds
- D. sneezing and runny eyes

Answer: D

Medical History

A medical history is essential for a patient newly diagnosed with COPD in order to establish a baseline of health status for all body systems, comorbidities, and threats to health.

Age of Patient

The typical COPD patient is middle-aged or older. Men tend to have their first symptoms when they are older than 40 years. Patients with asthma, however, may present with symptoms early in life and respond to triggers such as dust, animals, pollens, seasonal allergies, and exercise.

Family Medical History

Often a family history of smoking exists and, in the case of second-hand smoke, provides valuable information in diagnosing COPD. For the rare condition of a genetic mutation, a family history can help differentiate the types of COPD.

Lifestyle

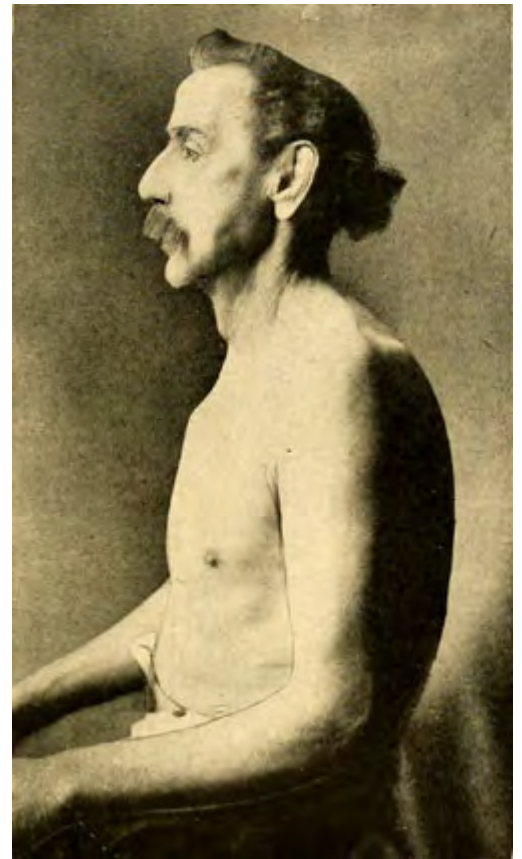
COPD is associated with smoking and exposure to environmental pollutants. The most likely contributing lifestyle choice is cigarette or cigar smoking. This is a controllable risk factor and should receive intensive attention both in treatment and in prevention of additional complications.

Physical Findings

Barrel Chest of COPD

A thorough head to toe examination should be completed, including vital signs to identify respiratory rate and pulse oximetry. Inspection should include hyperexpansion of the chest and thorax, and signs that accessory muscles may be used (retractions, nasal flaring), especially in children. Note the appearance of hunched-over shoulders or chest deformity. Inspection of the skin may also identify concomitant eczema, dermatitis, or other irritations that may signal an allergy. Observation may reveal **clubbed fingers**, due to hypoxia of the finger tissues. Auscultation of lung sounds is a focused assessment and should note wheezing during normal expiration or prolongation of expiration as seen in asthma (Glass, 2014).

Physical diameter of the chest, where the anterior to posterior ratio is $>2:1$, may be an indication for COPD. Men with COPD often develop a **barrel chest** appearance from the gradual expansion of stiff lungs that don't exhale properly; this traps air and forces the musculature to widen.



Note the expanded posterior of the man's chest and the rounding of the dorsal cavity. Source: Wikimedia Commons.

Laboratory Tests

Spirometry

Extensive quantitative research has recommended use of spirometry for diagnosis of COPD (Global Initiatives, 2014). Yet, even though the HEDIS measure is to use spirometry for diagnosis, it continues to be underused (NCQA, 2016).

Based on the Global Initiative for Chronic Obstructive Lung Disease (2014), the majority of patients with COPD have moderate to severe disease due to late or incorrect diagnosis, which increases overall medical costs and the number of exacerbations experienced by the patient.

Organizations specializing in respiratory care strongly suggest that the use of spirometry for both diagnosis and management be standardized. Since 1947, the ratio of vital capacity (FVC) to forced expiratory capacity in 1 second (FEV1) had been the scientific parameter physicians used to measure lung health (Brusasco & Pellegrino, 2016); but the GOLD standard established in 2001 identified the $FEV1/FVC < 0.70$ as a "rule of thumb" to define air flow obstruction.

Some authorities, however, have proposed other ranges—from $<0.75\%$ by the American Thoracic Society in 1986 to $<0.75\text{--}0.80\%$ by the Global Initiative for Asthma in 2015 (GINA, 2015). These differences are due to variations among ethnic groups studied. The differential diagnoses included COPD, asthma, heart failure, bronchiectasis, pulmonary edema, pneumonia, or cancer.

Completing a spirometry test correctly is essential for a valid diagnosis of COPD. Although there are variations with machines, the basic concept is to have the patient breathe in deeply and then forcefully exhale for 1 full minute. The measurements are collected after three separate attempts, which measure the forced expiratory effort (FEV1) at 1 minute. Remember to identify gender, ethnicity, and height on the machine because each of these impact total lung capacity and the result is calculated based on these factors in addition to performance. Less than 70% of FEV1 may indicate COPD. Interpretation of test results is important to distinguish among all types of COPD.

Spirometry Examination Being Conducted



Source: Wikimedia Commons.

Because treatment for COPD is contingent upon spirometry results, Mark's spirometry test needed to be completed to determine the stage of damage to his lungs. The FEV1/FVC ratio for Mark came back 60%, which is below the 70% predicted value and diagnostic for Stage II COPD. A chest x-ray was also ordered to rule out any other diagnosis being considered. It came back negative. ABGs, an EKG, and an echocardiogram could have been completed but were not at this time.

Classifying COPD

Currently, COPD is classified based on severity. Most recommendations include a consideration of both the spirometry results of the FEV1 and the patient's symptoms to determine the class and severity of COPD. Spirometry confirms the diagnosis and the pulmonary function test classifies the severity.

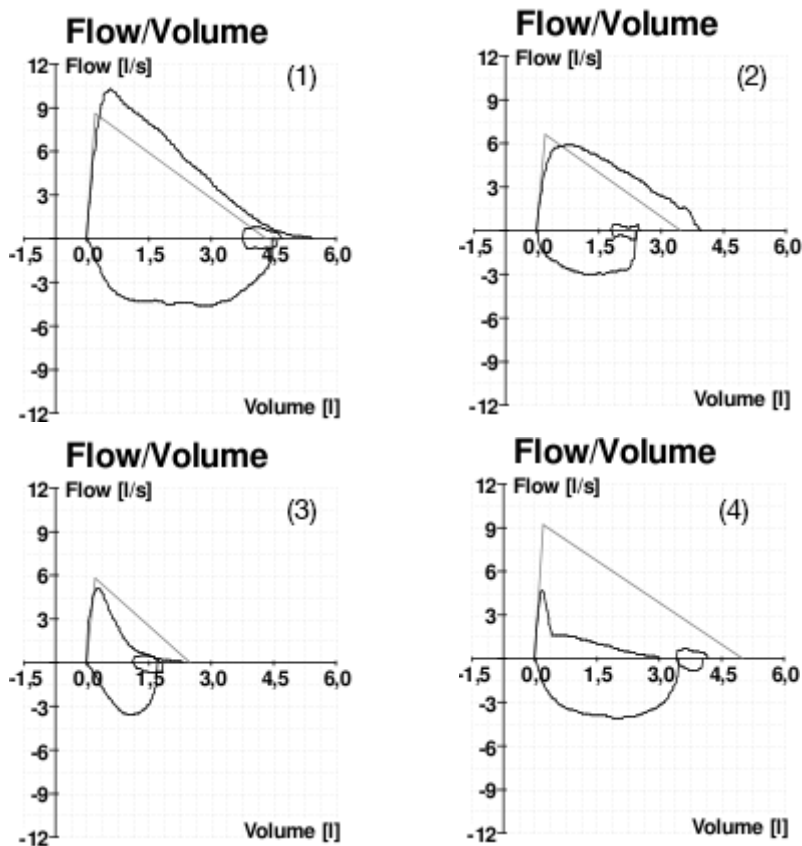
According to the GOLD standards, which are reviewed annually, the current classes are as follows in the table below.

Classes of COPD		
Stage	Symptoms	Post bronchodilator FEV1
1	Mild	>80%
2	Moderate	50–80%
3	Severe	30–50%
4	Very severe	<30%

Mark was scheduled for a two-week followup pending the results of his spirometry examination. When he returned to the clinic, his physician showed him the spirometry results and explained that he had COPD. She reviewed his treatment plan and gave him a pamphlet and educational materials.

Mark also got a prescription for a short-acting bronchodilator, to be used as needed, and a daily long-acting bronchodilator. He was encouraged to stop smoking and offered smoking cessation resources; options included a group support class or pharmaceuticals for nicotine replacement. Mark refused information about smoking cessation.

Flow Volume of Four Patients



These four images of spirometry come from (1) a patient without COPD; (2) a patient with poor effort during the spirometry test; (3) a patient with asthma; (4) a patient with COPD.

Source: Wikimedia Commons.

Online Resource

YouTube (7:23): Peak-Flow Spirometry—Lung Function Tests

<https://www.youtube.com/watch?v=M4C8EInOMOI>

Imaging Studies

A full range of imaging techniques is employed in diagnosis of COPD.

Chest X-Ray

In diagnosing COPD, a chest x-ray, which shows lung size and clarity and heart size, is a priority when considering the possibility of accompanying heart failure.

Remembering that the heart and lungs work synergistically, and any chronic complication of the lungs can affect the heart.

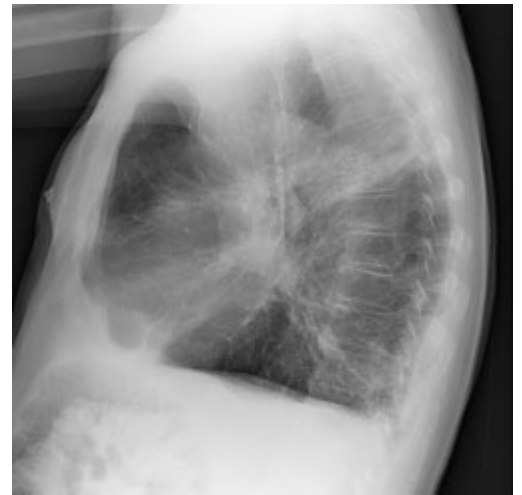
81-Year-Old Male with COPD

Computed Tomography (CT)

Computed tomography (CT) uses x-rays to produce a series of images of each part of the thoracic cavity, including the lungs and heart. A full thoracic CT can provide valuable information about the size of the lungs and the heart if the need to assess for lung cancer or congestive heart failure is part of the patient scenario and diagnosis.

Magnetic Resonance Imaging (MRI)

A thoracic MRI also allows a full look at the anatomy of the lungs, including the heart, in ruling out other pathologies such as lung cancer or congestive heart failure that may be complications of COPD.



Lateral view of an 81-year-old man with COPD and the resultant enlarged lungs that appear cloudy instead of clear, the barrel chest resulting from the dorsal cavity becoming rounded from hyperinflation of the lungs. Source: Wikimedia Commons.

Prognosis

Because there is no cure for COPD the prognosis is inevitably death. There is huge variation in morbidity due to variations on the other factors such as age, smoking history and current smoking status, comorbidities, compliance with medications, nutrition, and exercise tolerance.

Online Resource

YouTube (4:23): COPD—How to Recognize it on a Chest X-Ray

<https://www.youtube.com/watch?v=y82dL8QAUF8>

Apply Your Learning

What are the characteristics of a chest x-ray on someone who has COPD?

Test Your Learning

When examining patients with suspected CAD, chest x-rays:

- A. Can give a definitive diagnosis.
- B. Are not useful.
- C. Will highlight the ischemic regions of the heart.
- D. Are used to recognize possible co-existing heart failure.

Management of COPD

Damage done by COPD to airways and the lungs is not reversible. Although currently there is no medical cure available for lung tissue damage, adopting regular medical care and consistent lifestyle changes can help slow the progression of the disease.

Goals of Management

The major goals of COPD treatment are:

- Relieve symptoms
- Slow the progression of the disease
- Improve exercise tolerance
- Prevent and manage complications
- Improve overall health

Patients with newly diagnosed COPD should have a followup appointment in 4 to 6 weeks to assess for adherence as well as any problems with the new medication. They should also be referred to a smoking cessation program, counseling, or support group. In every state, the 1-800-Quit-Now phone number is a helpful resource. At each and every visit the patient should be questioned about smoking cessation progress to either celebrate triumphs or be encouraged with resources to stop smoking.

A cardiopulmonary rehabilitation referral is also appropriate per practice guidelines at Stage II COPD. A quarterly visit for the first year is appropriate because the patient needs to be referred for an annual flu shot and education regarding inhalers, spacers, and equipment. Education by referral may be needed if it is not provided in the office of the primary care provider.

Initial Management

At patients' initial visits, the healthcare provider should initiate a conversation about the possible causes for their clinical presentation. A simplified list of differential diagnoses can be shared with the patient before any diagnostic test is ordered. This lays the foundation for patients' understanding that they are part of the healthcare team in making decisions about their own plan of care. Patients should be given the opportunity to share opinions and choices within the recommendations for the standard of care.

The current GOLD Standards are established by numerous research studies and the CDC, and include the following:

1. The Global Initiative for chronic obstructive lung disease (GOLD) is the standard for diagnostic and treatment guidelines.
2. General interventions are comfort measures based on the severity of the symptoms and causative factors.
3. Smoking cessation should be mandatory because it is the number one causative factor. Smoking cessation should be discussed at every visit.
4. The selection of inhalers depends on the age of the person.
5. Nutrition management should be included because 25% of COPD patients are malnourished; eating competes with breathing so meals are limited. Encourage higher calorie supplements such as Ensure to deliver needed nutrients.
6. Pharmacologic therapy is based on spirometry and stage of disease. For stage I, short-acting bronchodilators (SABA) are prescribed as needed for shortness of breath. For stage II, a SABA plus a long-acting bronchodilator (LABA) should be prescribed. The stage III patient should have a SABA, LABA, plus an inhaled glucocorticoid if the patient has frequent exacerbations. Stage IV patients need all given in stage III plus cardiopulmonary rehabilitation and possibly O₂ delivery. All patients should receive an annual flu vaccine, one pneumonia vaccine after age 65 (and every 5–10 years for high risk patients) (Grossman & Porth, 2014).

Oxygen Use

Because the issue with COPD is decreased air flow, the main goal of therapy is to help the patient's lungs provide sufficient oxygen to the body. If the patient is short of breath, hypoxemic,* or has obvious signs of heart failure, oxygen should be titrated to saturation levels $\geq 93\%$ (Jarvis, 2015).

* *Hypoxemia vs. hypoxia.* **Hypoxemia** is abnormally low arterial oxygen tension (PaO₂) in the blood (hence the -emia ending). **Hypoxia** a condition of under-oxygenation, which is an inadequate level of tissue oxygenation for cellular metabolism. *Hypoxemia* frequently results in *hypoxia*—but not always!

A concern is oxygen toxicity and vasoconstriction. Oxygen causes constriction of the coronary, cerebral, renal, and other key vasculatures. If perfusion decreases with blood hyper-oxygenation, the administration of oxygen may place tissues at increased risk of hypoxia. Hyperoxia reduces coronary blood flow by 8% to 29% in normal individuals and in patients with coronary artery disease or chronic heart failure.

Although oxygen supplementation is a modality used only in the end stages of COPD, it is still a fundamental intervention. Care must be taken when giving oxygen to patients with COPD because their drive for inhalation is based on carbon dioxide retention, which they become used to. If additional oxygen is given, it may decrease the drive to breathe and further complicate oxygenation.

Online Resource

Video (7:33): Management and Treatment of COPD

<https://www.youtube.com/watch?v=9-ErVE--vjM>

Patient Education

It is essential that patients be taught about the possible cause of their COPD, and their own treatment plan, so they can understand the importance of being a member of the care plan team. Modification of triggers should be taught first—notably cessation of smoking, alcohol, and caffeine. Behavioral lifestyle changes include weight loss. Patients need to know that COPD is a chronic disease and there is no cure. Advance directives should be taught and put in place. The following actions are recommended:

- Give the patient a prescription for antibiotics to be filled upon worsening of symptoms, according to the GOLD standard.
- Teach patients to conserve their energy and plan for activity.
- Teach patients how to use a peak-flow meter at home to measure their breathing ability and to alert their provider if they reach the red target zone.
- Teach the COPD action plan and encourage them to become active participants in their own care. (Glass, 2014)

Therapeutic Lifestyle Changes

With commitment and perseverance, a person can significantly reduce the deterioration of respiratory function of COPD. The categories of therapeutic lifestyle changes that have been scientifically demonstrated to be good treatments for COPD—namely, smoking cessation, maintaining habits of healthy living that include eating a diet low in saturated fat and high in fruits and vegetables, exercising daily, and losing weight (if relevant).

The job of the healthcare team is to work with the patient to personalize these familiar recommendations. Healthcare providers must offer practical advice that the patient can reasonably follow and *that the patient believes is worth following*.

Smoking Cessation

Lifestyle changes begin with smoking cessation. Carbon monoxide and other poisons in cigarette smoke damage many types of cells in the body. Carbon monoxide also reduces blood oxygenation, stressing the oxygen-hungry heart. This stress is compounded by the nicotine in cigarette smoke. Nicotine constricts blood vessels and causes the heart to work harder, raising heart rate and blood pressure—two effects that increase the heart’s workload (Mitchell & Schoen, 2009).

Cigarette smoking accelerates coronary atherosclerosis in both sexes and at all ages, and increases the risk of thrombosis, plaque instability, MI, and death. In addition, it aggravates angina by increasing myocardial oxygen needs and reducing oxygen supply (NIH, 2016).

People who stop smoking reduce their risk of death from CAD from 35% to 50%; however, most people find it difficult to stop smoking. Clinicians can begin by telling patients that continued smoking increases their risk of serious heart problems and death, while quitting reduces this risk. They should then ask patients who smoke if they have thought about quitting. Whatever the answer, clinicians should follow with the offer, “When you *would* like to stop smoking, I’ll be happy to work with you to set up an effective program.”

Smoke-Free T-Shirt



Source: smokefree.gov.

Recommended Therapeutic Lifestyle Changes

- Less than 7% of daily calories should come from saturated fat. This kind of fat is found in some meats, dairy products, chocolate, baked goods, and deep-fried and processed foods.
- No more than 25% to 35% of daily calories should come from all fats, including saturated, trans, monounsaturated, and polyunsaturated fats.
- Cholesterol intake should be less than 200 mg a day.
- Foods high in soluble fiber help prevent the digestive tract from absorbing cholesterol. These foods include:
 - Whole-grain cereals such as oatmeal and oat bran
 - Fruits such as apples, bananas, oranges, pears, and prunes
 - Legumes such as kidney beans, lentils, chick peas, black-eyed peas, and lima beans

- Choose a diet rich in fruits and vegetables to decrease cholesterol. Compounds called plant stanols or sterols, work like soluble fiber.
- Fish such as salmon, tuna (canned or fresh), and mackerel are a good source of omega-3 fatty acids and should be eaten twice a week.
- Limit sodium intake. Choose low-salt and “no added salt” foods and seasonings.
- Limit alcohol intake. Too much alcohol raises blood pressure and triglyceride levels, and adds extra calories.
 - Men should have no more than two drinks containing alcohol a day.
 - Women should have no more than one drink containing alcohol a day. (NHLBI, 2006)

Many patients with COPD have concomitant CAD and heart risk factors. Nutrition for them must be tailored to meet their caloric needs. In the early stages of COPD, a cardiac diet is recommended; however, if a patient loses too much weight and becomes weak and cachectic, foods high in calories that are easy to consume, such as shakes and liquid nutritional supplements, should be offered.

Physical Activity

Regular exercise helps to reduce extra weight, stimulate the circulatory system, improve oxygen flow to the lungs, and promote mental alertness. However, when COPD becomes moderate to severe, simple physical activities such as walking to the door or even getting dressed can create dyspnea. Modifications in an exercise plan must be considered to conserve energy.

Exercise programs may have to be introduced gradually. At first, patients with moderate to severe COPD may be limited by the occurrence of dyspnea and will probably need to adapt even their normal activities. The appearance of chest pain or shortness of breath equivalents indicates that an activity is too strenuous, so patients should revise their normal activities to accommodate to their energy level.

Mass Reduction: Weight Loss

During the past twenty years, there has been a dramatic increase in obesity in the United States and rates remain high. Thirty-five percent of U.S. adults and approximately seventeen percent (12.5 million) of children and adolescents aged 2 to 19 years are obese. Obesity-related conditions include heart disease, stroke, type 2 diabetes, and certain types of cancer, some of the leading causes of preventable death (CDC, 2015, CDC, 2016).

Excess body weight makes the heart and lungs work harder, and excess fat fosters atherosclerosis. A person is considered overweight if their **body mass index (BMI, see chart below)** is 25 to 29.9 kg/m², while obesity is defined to be BMI >30 kg/m².

Calculating BMI is one of the best methods for population assessment of overweight and obesity. Because calculation requires only height and weight, it is inexpensive and easy to use for clinicians and for the general public. The use of BMI allows people to compare their own weight status to that of the general population. The standard weight status categories associated with BMI ranges for adults are shown in the following table (CDC, 2016).

BMI Chart

BMI less than 18.50	Underweight
BMI 18.50 - 24.99	Healthy weight
BMI 25.00 - 29.99	Overweight
BMI 30 or more	Obese

Source: Courtesy of webmd.com.

Weight management is a key part of the therapeutic lifestyle changes recommended for people with COPD. Patients should be encouraged to maintain a BMI <25 kg/m². Men should aim for a waist circumference <102 cm (40 in), while women should aim for a waist circumference <89 cm (35 in) (CDC, 2016). To measure waist size correctly, one should stand and place a tape measure around the middle, just above the hipbones and measure the waist just after breathing out.

Low-carbohydrate diets (<130 g carbs/day) seem to be about as effective and safe as low-fat diets. The most effective way to lose weight and to maintain the lower weight is participation in a comprehensive weight-loss program that combines diet, behavior modification, and regular exercise. Healthy weight loss must include a lifestyle of long-term changes in daily eating and exercise habits.

Evidence shows that people who lose weight gradually and steadily (about 1 to 2 pounds per week) are more successful at keeping weight off. In order to lose weight, a person must reduce their daily caloric intake and use up more calories than taken in. Since 1 pound equals 3,500 calories, caloric intake must be reduced by 500 to 1000 calories per day to lose about 1 to 2 pounds per week (CDC, 2015).

Even a modest weight loss—5% to 10% of total body weight—is likely to produce health benefits such as improvements in blood pressure, blood cholesterol, and blood sugars. Long-term success is achieved through healthy eating and physical activity most days of the week (about 60–90 minutes, moderate intensity) (CDC, 2016).

Management of Stress

For those with asthma and COPD, management of stress is needed to decrease the work of breathing. For many people with asthma, a psychological trigger such as a stressful event or even the fearful anticipation of a stressful event can trigger an acute asthmatic attack.

Test Your Learning

What are some general lifestyle recommendations for COPD?

- A. Smoking cessation, nutrition, and weight control.
- B. High fat diet to provide calories.
- C. Low fat and calorie diet to lose weight.
- D. Low salt diet.

Answer: A

Medications

Medications are used to manage all forms of COPD and may be used as monotherapy, dual therapy, or multi-drug therapy per the GOLD Guidelines for COPD control and management. The two main categories of medications that open the airways are the beta-2 bronchodilators, which can be remembered with the mnemonic **BAM**:

- B** bronchodilators,
- A** anticholinergics such as ipratropium, and
- M** methyl xanthines that stimulate the bronchioles to open, such as theophylline.

The second class of medications are the anti-inflammatories, which can be remembered by the acronym **SLM**:

- S** steroids,
- L** leukotrienes, and
- M** mast cell stabilizers.

Drug class	Action	Brand names
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Bronchodilators

Beta 2—Short acting (SABA)	Dilate bronchi	Albuterol (rescue inhaler) Salbutamol, Terbutaline
Long Acting Beta Agonists (LABAs)	Act on Beta 2 receptors to bronchodilate	Advair, Serevent, Foradil, Oxis, Salmeterol, Formoterol
Short Acting Beta Agonists (SABAs)	Act on Beta 2 receptors to bronchodilate	Albuterol, Ventolin, Proventil, Spiriva
Anticholinergics/Antimuscarinics (LAMA)	Increase sympathetic system to open airways	Ipratropium, tiotropium
Methylxanthines	Beta 2 stimulation to open bronchioles	Aminophyllin, Theophyllin, Unidur, Theodur

Anti-inflammatories

Steroids (Inhaled Corticosteroids)	Decrease inflammation in the lower airways	Fluticasone, Advair, Flovent, Pulmicort, Symbicort, Asmanex, Alvesco, mometasone
Steroid (Nasal)	Decrease inflammation in the upper airways	Nasonex, Nasacort, Veramyst
Leukotriene Antagonists (LTRAs)	Non-steroidal anti-inflammatory	Singulair, Accolate
Allergy Medications	Antihistamine Anti IgE blockers	Xolair, Claritin/Clarinet, Allegra, Zyrtec
Mast Cell Stabilizers	Decrease release of histamine	Cromolyn
Phosphodiesterase-4 PDE-4 Inhibitors	Suppress inflammation	Roflumilast

Recall that the physiology of the airways is largely controlled by two main nervous system receptors, the muscarinic and beta receptors, and blocking the muscarinic or stimulating the beta receptors will increase the airways.

A way to remember the different kinds of medication used for COPD is to remember the drug name endings:

- The muscarinic **antagonist** drugs end in "ium" (ipratropium, tiotropium, and UMclidinium).
- A new drug called glycopyrrolate is a **muscarinic**, so drugs that ends in "ate" will remind you that the drug "ate" the effects of muscarinic receptors.
- All of the respiratory **beta agonist** drugs end in "ol" (similar to cardiac beta blockers ending in "ol"). Drugs such as formoterol, salmeterol, and albuterol are beta agonists and increase the airway diameter.
- The inhaled **corticosteroids** end in "one" (fluticasone, mometasone).

COPD vs. Asthma Protocols

A medication grid can help you remember the progression of adjunct medication for both COPD and asthma.

Medication Endings Grid for COPD and Asthma				
COPD	LAMA	LABA	ICS	Asthma
→SABA	"ium"	"ol"	"one"	←SABA

Notice in the grid that, whereas treatment for COPD starts on the left (LAMA) and moves toward the right, asthma begins with an ICS and moves to the left in terms of adjunct medications.

Advancement of treatment depends on the frequency of the use of the SABA (rescue inhaler). Someone with COPD who is using a SABA more than 2x/week would advance from a LAMA to adding on a LABA and then later to the third class of medication, the ICS. If the patient with COPD or asthma is not using the rescue inhaler (SABA) more than two times weekly, then they do not need to advance in medication treatment.

In contrast, someone with asthma who is using the SABA (rescue inhaler) more than 2x/week would add only an ICS medication, advance to the LABA, and then last add the LAMA.

To summarize from the grid: For **asthma**, the first medication to use after the SABA is the ICS. Asthma patients will never use a LABA without using the ICS. The last medication to use for asthma is a LAMA. For **COPD**, the first class of medication to use after the SABA is the LAMA, with advance to the LABA, and finally to the ICS. Many pharmaceutical companies offer dual combination therapies for ease of use.

Inhaled Medications

Each of the drugs discussed above is available as an inhaled medication—in metered dose, breath-activated, or oral form.

Inhaled medications for COPD use different mechanisms to open the airways. Spacers may be used to enhance the drug delivery. Nebulizers can also be used for oxygen, or oxygen can be added through a liquid drug via a face mask. Many of these medications can be given intravenously for critically ill patients. Each class of medications is described below.

Bronchodilators

Inhaled bronchodilators are the key medications to opening the airways because they act on the beta receptors of the bronchiole tubes to cause bronchodilation. Bronchodilators relax the smooth muscles around the bronchioles, which dilates the air tubes, allowing more air to pass through.

Most bronchodilators are taken with inhalers so the medication goes directly to the airway. Both short-acting bronchodilators (SABA) and long-acting bronchodilators (LABA) work directly on opening the airways. The short-acting agonists are for an **acute exacerbation** when the airway closes suddenly, whereas the long-acting bronchodilator agonists (LABAs) are to be taken daily on a regular schedule to maintain the patency of the airways. Generally, SABAs are more expensive than LABAs. Each has a rapid onset of action and can be used symptomatically or before exercise.

Short-acting beta-2 agonists work within several minutes for a duration of 3 to 5 hours, as compared to long-acting beta-2 agonists, which last 12 hours. Each has side effects similar to drugs that mimic the sympathetic system, including fine tremors, muscle cramps, nervous tension, palpitations, tachycardia, sleep disturbances, hypokalemia, and occasionally paroxysmal bronchospasm.

An Asthma Inhaler



Source: Wikimedia Commons.

Anti-Muscarinics/Anti-Cholinergics

This class of medications causes bronchodilation and reduces mucus secretion by blocking muscarinic receptors in the lung. These drugs have a longer action and greater bronchodilator effect than the beta-2 agonists and are used in both COPD and asthma. Side effects include dry mouth, nausea, and constipation, and they can cause urinary retention (so must be used with caution for those patients with bladder problems and also those with glaucoma). Short-acting anti-muscarinics can be inhaled or nebulized and include ipratropium. The long-acting tiotropium can only be given by an inhaler.

Methylxanthines

This class, which includes theophylline, stimulates the beta-2 receptors on the lungs to allow bronchodilation. It can be given orally or intravenously. This class works by inhibiting phosphodiesterase or blocking adenosine. It is often given in acute asthma. Side effects include gastrointestinal upset, cardiac palpitations, tachycardia, arrhythmias, headache, insomnia, and convulsions.

Steroids

Inhaled corticosteroids (ICS) are generally the second adjunct therapy suggested by the GOLD Guidelines. They help reduce inflammation in the airways and lungs. Inhaled steroids should not be used as monotherapy but in combination with a bronchodilator. Because this class is a steroid, it may increase blood sugar levels and complicate control for patients who also have diabetes. This class of medications also may cause oral thrush because the oral inhaler delivers glucocorticoids directly to the mouth. It is recommended that this class of oral inhaler be given last for COPD and then the mouth be rinsed immediately after ingestion. As we have seen, it is often the first class of medications for asthma after short-acting bronchodilators and the same caution applies.

Steroids can be given via various routes including inhalation (beclometasone, budesonide), orally in the form of prednisolone, and IV in the form of hydrocortisone.

Systemic side effects of long-term corticosteroids are numerous and affect every body system. In the endocrine system we see blood sugar levels rise; in the musculoskeletal system, myopathy; neurologically, there can be growth retardation and psychiatric disturbances; in the integument, impaired wound healing, sodium and water retention; finally, glaucoma and central redistribution of fat are other common side effects.

Leukotriene Receptor Antagonists

This class of drugs is used to block the effects of leukotrienes, which would normally stimulate the mast cells to release histamine. When histamines are released, vasodilation and fluid movement to the site are natural reactions of the inflammatory response, which is the cause of many symptoms of COPD. In blocking this reaction, lungs may have less mucus build-up and air can move more easily in ventilation. Omalizumab (Xolair) is given orally; it is an anti-IgE monoclonal medication and is used in severe cases of asthma (but it is very expensive). Side effects include gastrointestinal disturbances, headache, insomnia, arthralgias, myalgias and, rarely, bleeding disorders.

Phosphodiesterase-4 (PDE-4) Inhibitors

If COPD symptoms continue, this class of medication may be added. It is the newest class of medications and suppresses inflammation in the airways.

Pulmonary Rehabilitation

Pulmonary rehabilitation includes the combined efforts of a customized exercise program, nutrition counseling, disease management training, and psychological counseling. The goal is to help reduce symptoms and minimize acute exacerbations.

Surgical Interventions

Lung-volume reduction (LVR) surgery is not used to “cure” COPD but is used to remove damaged lung tissue, which allows better expansion of the remaining lung tissue. Lung transplantation, the replacing of a damaged lung with a donor lung carries additional risks of rejection and infection.

Followup and Evaluation

The followup may be simply a return to clinic if symptoms worsen. COPD patients should be monitored regularly, beginning with every 3 months, then 6 months, and then at least annually. Referrals to a pulmonologist are necessary if symptoms persist or worsen. Monitoring levels of serum theophylline, which has a very narrow therapeutic range, before each visit can help the clinician to modify the medication regimen and avoid adverse effects.

Mark, our 62-year-old patient, was given a medication regimen and referred to a smoking cessation program. Mark wanted to try to quit smoking on his own. If unsuccessful, he was willing to try a nicotine patch. He was also given a short-acting beta agonist and a rescue inhaler and was taught how to use it for episodes of shortness of breath. In addition, Mark was given a long-acting antimuscarinic, ipratropium, in an Atrovent inhaler to be taken daily.

Mark would return to the clinic in 1 month to evaluate his symptoms and progress. He would continue to be followed every 3 months for progress toward smoking cessation and control of symptoms. He is slated to be seen annually to review the PFT (pulmonary function test) and assess for any new complications and to provide education, prophylactic antibiotics, and a flu shot.

Online Resource

YouTube (2:17): How to Use a Metered Dose Inhaler

<https://www.youtube.com/watch?v=fHYTz-ZoRLw>

Test Your Learning

What are the most common side effects for bronchodilators?

- A. Fatigue, lack of appetite, and urinary incontinence
- B. Nausea, vomiting, and diarrhea
- C. Restlessness, tachycardia, and heart palpitations
- D. Muscle pain and hypotension

What class of medications decreases inflammation seen in COPD?

- A. Bronchodilators
- B. Anticholinergics
- C. Steroids and leukotriene receptor antagonists
- D. Methylxanthines

In addition to a short-acting bronchodilator (rescue inhaler), which medication class is generally the first line of therapy for patients with asthma?

- A. Inhaled corticosteroid
- B. Long-acting bronchodilator
- C. Anticholinergic
- D. Mast cell stabilizer

Answers: C,D,A

Major Complications of COPD

Acute care generally focuses on management of breathing (Glass, 2014). Chronic management requires daily use of medications to open the airways and avoid complications. Acute exacerbations need to be treated immediately for airway management. Complications of COPD can become life threatening beyond just shortness of breath and limitations of activities to include pneumonia, heart disease, hypertension, cardiac arrhythmias, and congestive heart failure. Although COPD may be controlled, it may also suddenly worsen due to an additional respiratory problem such as a cold or flu. If additional symptoms of fever, difficulty breathing, chest tightness, or increased coughing develop, patients should see their primary care provider immediately for treatment.

In addition to the complications of ineffective breathing, the body is stimulated to make more red blood cells in an effort to compensate for hypoxia in the tissues. This results in thickened blood, with possible risk for thromboembolism and pulmonary hypertension as the pressure within the lungs increases.

The blood flow from the pulmonary artery backing up into the heart can eventually lead to left-sided heart failure, or **blue bloater**. If a patient is a smoker, the chronic irritation to the alveoli also stimulates the inflammatory response, which creates vasodilation, release of histamines, and alveolar stiffening. With chronic hypoxia, the patient will also develop chronic hyperventilation as a compensatory mechanism.

- **Respiratory complications** include acute respiratory distress syndrome (ARDS), spontaneous pneumothorax, lung cancer, contagious lung infections such as pneumonia, acute bronchitis, and upper respiratory viral colds and flu.
- **Cardiac complications.** Because COPD is caused by a lack of oxygenation to the tissues of the body, the resultant hypoxia can create hypertension, coronary artery disease, and congestive heart failure.

Prevention Strategies

Although COPD does not cause influenza or pneumonia, people with COPD are at greater risk because their airways are already reduced.

Influenza and Pneumonia Vaccination

Patients who have COPD should urgently get a seasonal flu shot every year. Those over age 65 should also get a pneumonia vaccine.

Prophylactic Antibiotic Prescription

Currently the GOLD Standard of care encourages an annual review of comorbidities and prescription for general antibiotics in the event of an upper respiratory infection. This standard encourages a healthcare provider to see the patient at least once annually and write out a prescription in case the patient begins to feel shortness of breath from an upper respiratory infection and cannot be seen by the provider immediately.

Peak-Flow Meter Use

The use of a personal peak-flow meter allows individuals to assess their own current lung status, which can be helpful in preventing an acute exacerbation of air restriction, such as an asthma attack. The peak-flow meter uses the traffic signal colors of green for good control, yellow for caution, and red for stop and see your healthcare provider and use your rescue inhaler. The yellow zone indicates there is a progressive difficulty in breathing, which may be from weather conditions, such as an increase in smog or wind, which may put the patient at risk for airway closure. By teaching patients to use their home peak-flow meter, they can assess their own respiratory function and make necessary precautions and adjustments.

Peak-Flow Meters



Source: Wikimedia Commons.

Test Your Learning

Which tool is used for home use to determine general air flow?

- A. Incentive spirometry
- B. Peak flow meter
- C. Spirometry
- D. Nebulizer

What does pulmonary rehabilitation include?

- A. Vigorous exercise
- B. Caution against antibiotics
- C. Ten step program
- D. Breathing coaching

Answers: B,D

Summary

COPD is a chronic and incurable respiratory condition that has three categories: asthma, chronic bronchitis, and emphysema. Risk factors include smoking and exposure to environmental allergens and pollutants that trigger the lungs and alveoli to become inflamed and produce mucus, resulting in narrowed airways. COPD is a condition of restricted air flow and causes complications throughout the body related to chronic hypoxia.

Diagnosis is based on a history of exposures to allergens (mainly cigarette smoking), symptoms, and a physical examination. Clinical symptoms include shortness of breath, coughing, wheezing, and dyspnea. Diagnostic tests include spirometry as the GOLD standard and may include radiography to visualize the size of the lungs.

Treatment includes management of symptoms, medications, lifestyle modifications; in addition, education for pulmonary rehabilitation to avoid acute exacerbations and improve the quality of life. There is no cure but there are many classes of medications to assist with bronchodilation and decrease inflammation of airways and lungs.

Resources and References

Resources

About.com

COPD guide that covers everything from the definition and symptoms of COPD to diagnosis, treatment, and living with COPD.

American Lung Association

With information that includes how to stop smoking, the ALA is committed to “Fighting for Air” and publishes a highly informative website about lung diseases and lung disorders.

British Lung Foundation

The U.K.-based BLF charity provides information for a number of lung diseases. The site’s COPD section also offers information in multiple languages, including Bengali, Gujarati, Hindi, Punjabi, Turkish, and Urdu.

Centers for Disease Control and Prevention (CDC)

This respected U.S. government resource offers information about COPD, including a list of relevant publications and resources for further research.

COPD Foundation

This U.S.-based not-for-profit organization’s mission is to develop and support programs that improve the quality of life through research, education, early diagnosis, and enhanced therapy for persons whose lives are impacted by chronic obstructive pulmonary disease.

COPD Digest

A good source for up-to-date developments, this digest is published by the COPD Foundation.

Global Initiative for Chronic Obstructive Lung Disease (GOLD)

GOLD works with healthcare professionals and public health officials to raise awareness of COPD and to improve prevention and treatment of this lung disease for patients around the world. Their website includes information about World COPD Day.

National Heart, Lung and Blood Institute

<https://www.nhlbi.nih.gov/health-topics/education-and-awareness/copd-learn-more-breathe-better>

World Health Organization (WHO)

Global perspective on COPD, including world statistics and NGO and government-sponsored efforts to combat the diseases.

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Post Test

Use the answer sheet following the test to record your answers.

1. What conditions are included in the definition of COPD:
 - a. Asthma, emphysema, and acute bronchitis.
 - b. Asthma, chronic bronchitis, and emphysema.
 - c. Asthma, pneumonia, and acute bronchitis.
 - d. Emphysema, chronic bronchitis, and cystic fibrosis.

2. In the United States, which statistic about COPD is true:
 - a. One in three people have COPD.
 - b. Women are more at risk of COPD than men.
 - c. COPD is the third leading cause of death.
 - d. Hispanics and African Americans are at the same risk of developing COPD.

3. Who is at greatest risk for developing COPD:
 - a. A 50-year old woman who smoked 1 pack daily for 30 years.
 - b. A 70-year old man whose wife smokes outdoors only.
 - c. A 63-year old woman who has never smoked but works in an industrial company as a secretary.
 - d. A 50-year old man who smoked 2 packs of cigarettes per day for 25 years.

4. What is the pathology of COPD within the bronchioles:
 - a. The bronchioles are not affected, but the alveoli become hyperinflated.
 - b. The bronchioles become constricted and often are full of mucus.
 - c. The bronchioles become expanded and the alveoli constrict.
 - d. The cilia within the trachea become elongated to compensate for the closing airways.

5. Which one is a cause of all three types of COPD:
 - a. Inflammation and environmental triggers
 - b. Cigarette smoking
 - c. Industrial pollutants

- d. Genetic mutations in mucus production
6. Which of the following is **not** a symptom of COPD:
- a. shortness of breath on exertion
 - b. tachypnea
 - c. wheezing and adventitious lung sounds
 - d. sneezing and runny eyes
7. When examining patients with suspected CAD, chest x-rays:
- a. Can give a definitive diagnosis.
 - b. Are not useful.
 - c. Will highlight the ischemic regions of the heart.
 - d. Are used to recognize possible co-existing heart failure.
8. What are some general lifestyle recommendations for COPD:
- a. Smoking cessation, nutrition and weight control.
 - b. High fat diet to provide calories.
 - c. Low fat and calorie diet to lose weight.
 - d. Low salt diet.
9. What are the most common side effects for bronchodilators:
- a. Fatigue, lack of appetite, and urinary incontinence
 - b. Nausea, vomiting, and diarrhea
 - c. Restlessness, tachycardia, and heart palpitations
 - d. Muscle pain and hypotension
10. What class of medications decreases inflammation seen in COPD:
- a. Bronchodilators
 - b. Anticholinergics
 - c. Steroids and leukotriene receptor antagonists
 - d. Methylxanthines
11. In addition to a short-acting bronchodilator (rescue inhaler), which medication class is generally the first line of therapy for patients with asthma:

- a. Inhaled corticosteroid
- b. Long-acting bronchodilator
- c. Anticholinergic
- d. Mast cell stabilizer

12. Which tool is used for home use to determine general air flow:

- a. Incentive spirometry
- b. Peak flow meter
- c. Spirometry
- d. Nebulizer

13. What does pulmonary rehabilitation include:

- a. Vigorous exercise
- b. Caution against antibiotics
- c. Ten step program
- d. Breathing coaching

Answer Sheet

Chronic Obstructive Pulmonary Disease (COPD)

Name (Please print your name): _____

Date: _____

Passing score is 80%

1. _____

2. _____

3. _____

4. _____

5. _____

6. _____

7. _____

8. _____

9. _____

10. _____

11. _____

12. _____

13. _____

Course Evaluation

Please use this scale for your course evaluation. Items with asterisks * are required.

- 5 = Strongly agree
- 4 = Agree
- 3 = Neutral
- 2 = Disagree
- 1 = Strongly disagree

* Upon completion of the course, I was able to:

a. Define Chronic Obstructive Pulmonary Disease.

5 4 3 2 1

b. Discuss the prevalence, incidence, and morbidity/mortality of COPD.

5 4 3 2 1

c. Explain how the A&P of breathing is affected by COPD.

5 4 3 2 1

d. List the major causes of COPD.

5 4 3 2 1

e. Identify common clinical symptoms of COPD and how it is diagnosed.

5 4 3 2 1

f. State the goals of COPD management and identify lifestyle and pharmaceutical interventions.

5 4 3 2 1

g. Discuss major complications of COPD and list prevention strategies.

5 4 3 2 1

* The author(s) are knowledgeable about the subject matter.

5 4 3 2 1

* The author(s) cited evidence that supported the material presented.

5 4 3 2 1

* Did this course contain any discriminatory or prejudicial language?

Yes No

* Was the course free of commercial bias and product promotion?

Yes No

* As a result of what you have learned, do you intend to make any changes in your practice?

Yes No

If you answered Yes above, what changes do you intend to make? If you answered No, please explain why.

* Do you intend to return to ATrain for your ongoing CE needs?

- Yes, within the next 30 days.
- Yes, during my next renewal cycle.
- Maybe, not sure.
- No, I only needed this one course.

* Would you recommend ATrain Education to a friend, co-worker, or colleague?

- Yes, definitely.
- Possibly.
- No, not at this time.

* What is your overall satisfaction with this learning activity?

5 4 3 2 1

* Navigating the ATrain Education website was:

- Easy.
- Somewhat easy.
- Not at all easy.

* How long did it take you to complete this course, posttest, and course evaluation?

- 60 minutes (or more) per contact hour
- 50-59 minutes per contact hour
- 40-49 minutes per contact hour
- 30-39 minutes per contact hour
- Less than 30 minutes per contact hour

I heard about ATrain Education from:

- Government or Department of Health website.
- State board or professional association.
- Searching the Internet.
- A friend.
- An advertisement.
- I am a returning customer.
- My employer.
- Other
- Social Media (FB, Twitter, LinkedIn, etc)

Please let us know your age group to help us meet your professional needs.

- 18 to 30
- 31 to 45

46+

I completed this course on:

- My own or a friend's computer.
- A computer at work.
- A library computer.
- A tablet.
- A cellphone.
- A paper copy of the course.

Please enter your comments or suggestions here: _____

Registration Form

Please print and answer all of the following questions (* required).

* Name: _____

* Email: _____

* Address: _____

* City: _____ * State: _____ * Zip: _____

* Country: _____

* Phone: _____

* Professional Credentials/Designations:

Your name and credentials/designations will appear on your certificate.

* License Number and State: _____

* Please email my certificate:

Yes No

(If you request an email certificate we will not send a copy of the certificate by US Mail.)

Payment Options

You may pay by credit card or by check.

Fill out this section only if you are **paying by credit card**.

3 contact hours: \$19

Credit card information

* Name: _____

Address (if different from above): _____

* City: _____ * State: _____ * Zip: _____

* Card type:

Visa Master Card American Express Discover

* Card number: _____

* CVS#: _____

* Expiration date: _____