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### Chronic Obstructive Pulmonary Disease: Emphysema

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# Chronic Obstructive Pulmonary Disease: Emphysema

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## Introduction

Chronic obstructive pulmonary disease (COPD) is a chronic inflammatory lung disease that causes obstructed airflow from the lungs. Emphysema and chronic bronchitis are the two most common conditions that contribute to COPD.

As of 2013, it is estimated that 15.7 million adults in the United States have been given the diagnosis of COPD (Wheaton, Cunningham, Ford, & Croft, 2015).

COPD is currently the world's third leading cause of death and the fifth leading cause of years lived with disability (Adar, Kaufman, Diez-Roux, Hoffman, D'Souza, Stukovsky, & Barr, 2015).

Having such high prevalence in the country, nurse practitioners in the U.S. are consistently diagnosing and managing the care of COPD patients.

Understanding the pathophysiology and implications of nursing care for COPD patients is imperative to successfully care and manage this patient population.

## Underlying Pathophysiology

The pathologic changes which lead to emphysema stem from two main contributing factors, Alpha-1 Antitrypsin deficiency (AATD) and long term exposure to toxins.

- AATD is an autosomal codominant condition involving a mutation of the SERPINA1 gene. This gene is responsible for signaling the production of Alpha-1 Antitrypsin (AAT), an anti-protease which protects tissues from damage released by inflammatory cells (U.S. Department of Health, 2018).
- Proteases which are responsible for bacterial entrapment, pathogen phagocytosis, mucin hypersecretion and mucociliary clearance are usually kept in balance by AAT (Chillappagari, Preuss, Licht, Müller, Mahavadi, Sarode, & Henke, 2015). When there is a deficiency of AAT, neutrophil released proteases including neutrophil elastase, cathepsin G and proteinase 3 are not controlled leading to digestion of elastin and epithelial tissue damage (Turner, 2013).
- Exposure to toxins including smoking, air pollutants and occupational exposures can also contribute to the development of emphysema.
- Tobacco smoking is the leading cause of COPD which exerts its effects by causing an inflammatory response, cilia dysfunction, and oxidative injury (Sharifabad, 2018).
- After continuous inhalation of toxic substances the inflammatory response is initiated including macrophages, neutrophils and leukocytes which are responsible for the elastin breakdown and subsequent loss of alveolar integrity (Sharifabad, 2018).
- Elastin and collagen, which allow the alveoli to expand and contract during breathing, are destroyed by neutrophil and macrophage enzymes (Schiska, 2016).

Depending on the underlying cause of the destruction, the presentation and location may appear differently.

## Characteristics of damage distribution



(Han, Dransfield, & Martinez, 2018)

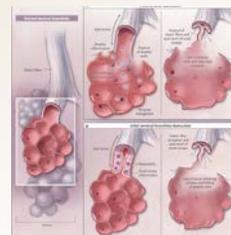


Fig. 1: Craig, Scott, & Mitzner (2017)

## Significance of Pathophysiology

- The loss of elasticity and enlargement of pulmonary alveoli, traps air within the lung. The trapped air in the floppy alveoli prohibits adequate intake of air during inspiration to perfuse the body with oxygen (Schiska, 2016).
- Patients with COPD often have a higher risk to develop other life threatening comorbidities including lung cancer. Several pulmonary mechanisms of inflammation and oxidative stress that damage DNA and result in an imbalance between tissue repair and cell proliferation seem to promote the link between COPD and lung cancer. Patients with emphysema have a higher risk for osteoporosis and loss of muscle mass than do patients with a predominant airway type of COPD (Rabe & Watz, 2017).
- AATD puts patients at a higher risk for developing liver injury if the patient is homozygous for the Z mutant allele of the SERPINA1 gene mutation. There are over 100 variant alleles of the SERPINA1 gene but this specific Z mutant allele causes injury to the liver directly from the accumulation of the abnormal, AAT mutant Z protein within liver cells (Teckman, 2013).
- Patients with emphysema might be subject to opportunistic lung infections, such as pneumonia, caused by buildup of bacteria in the lung (Schiska, 2016).
- Adults who reported having COPD were more likely to report being unable to work, having an activity limitation caused by health problems, having difficulty walking or climbing stairs, or using special equipment to manage health problems, compared with adults without COPD (Wheaton, Cunningham, Ford, & Croft, 2015).

## Implications of Nursing Care

COPD causes high resource utilization with frequent clinician office visits, frequent hospitalizations due to acute exacerbations, and the need for chronic therapy (Han, Dransfield, & Martinez, 2018). Focus should include preventing the disease from progressing and prevention of exacerbations.

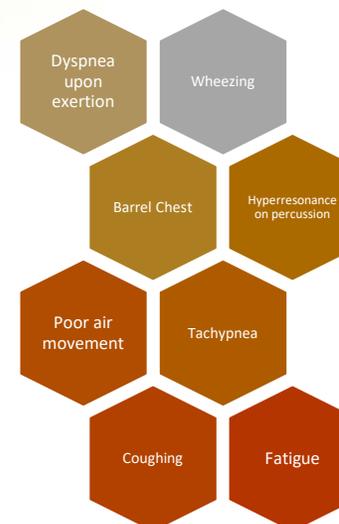
Education is an essential part of treating and caring for this patient population to avoid further complications and exacerbations.

- ❑ Smoking cessation and avoidance of toxic work exposures should be explained to those who currently have emphysema and to at risk groups.
- ❑ Physical activity should be encouraged to prevent further limitations from developing.
- ❑ Vaccination against influenza, pneumococcus and pertussis may help prevent opportunistic infections.
- ❑ Management of co-morbidities should be emphasized to prevent addition complications (Rennard, Thomashow, Crapo, Yawn, McIvor, Cerreta, & Mannino, 2013).

Treatment may vary greatly depending on the patient's disease progression and initial cause of the disease.

- ❑ AATD should be treated with augmentation therapy if the patient is presenting with symptoms of the disease.
- ❑ Acute exacerbation treatment consists of short acting bronchodilators, systemic and inhaled corticosteroids and antibiotics if indicated for infectious causes (Sharifabad, 2018).
- ❑ Long-term management of emphysema may require a combination of medications specific to each patient. These consist of anticholinergics, beta-2 agonist, and inhaled glucocorticosteroids (Rennard et al., 2013).

## Signs and Symptoms



(Sharifabad, 2018)

## Conclusion

Emphysema stems from different contributing factors and therefore requires a different course of action depending on the underlying pathophysiology. It is important for the practitioner to be aware of which contributing factors led to the disease in order to effectively treat the patient.

Recognizing the signs and symptoms will help differentiate this disease from others and lead to a prompt diagnosis. Knowing what co-morbidities can be affiliated with emphysema will be essential when treating the patient as a whole.

Diagnosing the patient appropriately based on the pathologic factors will help guide the practitioner to the proper treatment required.

Educating the patient on self care requirements along with guidance to live a healthier lifestyle to prevent exacerbations and rapid progression of the disease is necessary during their care.

COPD has a significant prevalence in the United States and it is imperative for practitioners to be educated on the pathophysiology and management of the disease to provide the best possible care for their patients.

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