Chronic Obstructive Pulmonary Disease

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Introduction

Chronic obstructive pulmonary disease (COPD) is a gradually progressive disease that affects the airways or pulmonary parenchyma, or both, and results in airflow obstruction (Qaseem et al., 2011). COPD is a set of diseases that limit airflow, cause irreversible changes, and include both emphysema and chronic bronchitis (CDC, 2017). “In the United States, COPD affects more than 5% of the adult population; it is the third leading cause of death and the 12th leading cause of morbidity. The total economic cost of COPD in the United States was estimated to be $49.9 billion in 2010, and the total direct cost of medical care is approximately $29.5 billion per year” (Qaseem et al. 2011, p.189). Advanced practice nurses can play an important role in helping to manage these patients. This student nurse practitioner has chosen this topic because of its prevalence and because personally caring for a family member with COPD from early childhood to adult life and the disease elaborates throughout progression to end of life. The purpose of this paper is to provide advanced practice nurses a review of the pathophysiology of COPD and provide current clinical guidelines for diagnosis and the management of this chronic disease. Although this paper will include some information on both emphysema and bronchitis, the primary focus will be on emphysema.

Risk Factors, Signs & Symptoms

Chronic Obstructive Pulmonary Disease (COPD) is a gradually progressive disease that affects the airways or pulmonary parenchyma, or both, and results in airflow obstruction (Qaseem et al., 2011). COPD is a set of diseases that limit airflow, cause irreversible changes, and include both emphysema and chronic bronchitis (CDC, 2017). “In the United States, COPD affects more than 5% of the adult population; it is the third leading cause of death and the 12th leading cause of morbidity. The total economic cost of COPD in the United States was estimated to be $49.9 billion in 2010, and the total direct cost of medical care is approximately $29.5 billion per year” (Qaseem et al. 2011, p.189). Advanced practice nurses can play an important role in helping to manage these patients. This student nurse practitioner has chosen this topic because of its prevalence and because personally caring for a family member with COPD from early childhood to adult life and the disease elaborates throughout progression to end of life. The purpose of this paper is to provide advanced practice nurses a review of the pathophysiology of COPD and provide current clinical guidelines for diagnosis and the management of this chronic disease. Although this paper will include some information on both emphysema and bronchitis, the primary focus will be on emphysema.

Pathophysiological Processes

Underlying Pathophysiology

A characteristic of COPD is the on-going inflammation affecting central airways, peripheral airways, lung parenchyma and the alveoli, as well as the pulmonary vasculature (Mitchell, 2015). These pathophysiological characteristics combine result in narrowing and remodeling of the airways, an augmentation of goblet cells, amplification of the mucus-secreting glands of the central airways and subsequent vascular bed changes leading to pulmonary hypertension (Mitchell, 2015). The primary feature of COPD is airway limitation that is not fully reversible (figure 1.). For those patients with emphysema, the smooth muscle in the airways becomes thickened and constricted which results in a narrowing of the airway. These narrowed airways are prone to collapse, particularly during expiration (Mitchell, 2015).

In emphysema, the surface area for gaseous exchange is severely reduced, resulting in the damaging of pulmonary capillaries which restrict the diffusion of gases, resulting in a mismatch between ventilation, and perfusion (Mitchell, 2015). According to Mitchell (2015), gas exchange [known as external respirations] takes place at the extremely thin alveolar capillary membranes by diffusion. Oxygen moves from the alveoli into the pulmonary capillaries as shown in figure 2; therefore blood leaving the lungs to go to the pulmonary veins and the left side of the heart should be saturated with oxygen and have dumped CO2 to be exhaled and eliminated by the body (p.445). Alveolar dead space (dead space ventilation) takes place when air remains in the conducting airways and is unable to reach the alveoli, due to alveolar damage. This then, is air that does not take part in alveolar ventilation (Mitchell, 2015).

Contraction of smooth bronchial muscle (bronchoconstriction), in addition to limitation in airflow from inflammation and mucus production, attribute to noisy musical sounds known as ‘wheezing’. This occurs mainly with expiration (Mitchell, 2015). Over secretion of mucus along with ciliary dysfunction leads to the chronic cough and sputum production most COPD patients experience (Mitchell, 2015).

Coughing is initiated by irritant receptors in response to chemical, inflammatory, or mechanical stimuli and is a defense mechanism to protect our airways. Coughing results in bronchoconstriction and hypersecretion of mucus. Chronic cough due to COPD manifests as prolonged bouts of production of thick and sputum filled mucus-secreting goblet cells in the mucus glands of the bronchial wall. Fatigue is a factor in ineffective coughing with COPD patients as well (Mitchell, 2015).

Dyspnea is the most prominent symptom in COPD patients and is typically the reason the patient seeks medical help (Mitchell, 2015). Changes in respiratory rate, pattern, depth, and degree of breathlessness are challenging for the APRN to assess because of the chronic nature of the disease as well as the subjective experience of dyspnea. Oxygen saturation is the ‘fifth vital sign’ and in COPD patients, dyspnea is to be considered a sixth vital sign (Mitchell, 2015).

Significance of Pathophysiology

Gas exchange at the alveoli changes over time in some COPD patients; this is due to factors that cause emphysema or bronchitis (Mitchell, 2015). Mitchell (2015) further discusses that this change happens with the body’s protective mechanism in an attempt to favorably change the natural course of COPD (p.445). When alveoli are unventilated (airless), full of fluid or infection (debris), or low in oxygen, bronchitis is diverted within the pulmonary capillaries to more ventilated alveoli with a higher level of oxygen to limit what is termed ‘shunting’ (low blood oxygen levels) resulting in blood circulating unevenly and returning to the left side veins unoxygenated (hypoxemia) (Mitchell, 2015). Hypoxemia results when the oxygen levels within the arterial blood are low, whereas hypoxia results when there is low oxygen levels at the cellular tissue level (Peate & Dutton, 2014, Ch. 5). Implications for Nursing Care

COPD is a disabling disease. Repetitive exacerbations result in a higher use of our health resources, especially among those patients with advanced COPD and comorbidities (Bourbeau & Saad, 2012). Bourbeau & Saad (2012) point out that the survival of the patient with COPD can learn and understand the disease process; progressive the better it will be for them. They discuss ways to achieve this mastery is by implementing self-management programs while following fundamental principles with respect to the patients’ needs and abilities (p.99). To achieve this, Bourbeau & Saad (2012) recognize the patient has to become more knowledgeable, and he has to develop the confidence, that is, self-efficiency, with respect to specific health behaviours and the recognized skills needed to cope on a day-to-day basis with this disease...also require the provision of continuity of care at the location where the patient lives” (p.99). The patient is completely in charge to manage their health care while following fundamental principles. The care giver must use best clinical judgement regarding treatment options on a case-by-case basis for these patients. Primary care nurses (APRNs) are ideally placed to provide the ongoing education and close monitoring to recognize symptoms and act on them early and accordingly.

References


