Summer 2022

Perioperative Management in Patients with Chronic Obstructive Pulmonary Disease

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Introduction

Perioperative Management of Patients with Chronic Obstructive Pulmonary Disease

- Chronic obstructive pulmonary disease (COPD) is a disease that constricts the airways and makes expiration difficult
- COPD results in three million deaths a year globally (Shin et al, 2017)
- COPD is becoming the third leading cause of death (Shin et al., 2017)
- There are different categories of COPD and periods of exacerbations, which are acute flare-ups that make symptoms severely worse and progress the disease (Elisha et al, 2023)

Why COPD?

- COPD is a very common diagnosis that can greatly influence the ventilation status of a patient (Park et al, 2020)
- In anesthesia, the anesthetist is responsible for controlling the body's response because the autonomic nervous system is sedated; COPD can have a substantial influence on how a patient should be ventilated
- Surgeons and anesthetists are graded based on patient outcomes postoperatively, and COPD increases the risk of patients experiencing a postoperative pulmonary complication (PPC) (Bustamante et al., 2017)

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Risk Factors

- Tobacco abuse (McCance & Huether, 2014)
- Occupational dust and chemicals
- Indoor air pollution from cooking and heating
- Outdoor air pollution (McCance & Huether, 2014)
- Genetics

Signs & Symptoms

- Dyspnea on exertion (Elisha et al, 2023)
- Persistent cough
- Coughing up mucus
- Wheezing with breathing (Elisha et al., 2023)
- Chest tightness
- Frequent colds or flu
- Blue fingernails
- Low energy
- Weight loss without trying (Elisha et al., 2023)
- Swollen ankles, feet, or legs
- Airway obstruction causes decreased ventilation and accumulation of PaCO2 and can lead to mental status changes (McCance & Huether, 2014)
- Chest Xray findings include hyper-lucency from arterial vascular deficiency and hyperinflation from flattening of the diaphragm, as seen in ***Figure 2*** (Elisha et al., 2023)

Underlying Pathophysiology

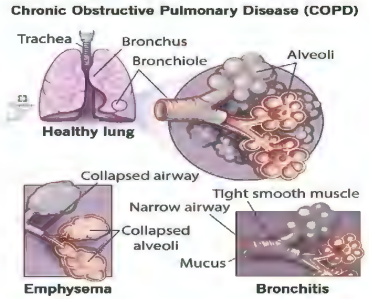
COPD is an umbrella term used when you have an underlying disease such as chronic bronchitis, emphysema, or asthma (Elisha et al., 2023).

Chronic bronchitis is hypersecretion of mucus and a productive cough for at least two years (McCance & Huether, 2014). Chronic bronchitis is caused by irritants causing inflammation in the airways. The inflammation leads to bronchial edema and thick, tenacious mucus. This causes compromised pulmonary defenses and increases the incidence of respiratory infections (McCance & Huether, 2014).

Emphysema is an abnormal enlargement of gas-exchanging airways and causes destruction of alveolar walls (McCance & Huether, 2014). The destruction of alveolar walls induces a loss of recoil of the lungs. The inherited deficiency of the enzyme a1-antitrypsin is the leading cause of primary emphysema. The leading cause of secondary emphysema is the inhalation of cigarette smoke or air pollution (McCance & Huether, 2014).

Asthma constricts the airways due to bronchiole hyperresponsiveness from an inflammatory disorder of the bronchial mucosa (McCance & Huether, 2014). Most patients can be asymptomatic until an antigen is present that causes wheezing, dyspnea, and use of accessory muscles to breathe. Patients may experience severe bronchospasm that leads to status asthmaticus (McCance & Huether, 2014).

Figure 1. **Pathophysiology of COPD** (Cleveland Clinic, 2021)



Significance of Pathophysiology

- COPD patients have compromised lung function and decreased ability to ventilate
- The lack of ventilation leads to a ventilation/perfusion mismatch called a V/Q mismatch (Elisha et al., 2023)
- The V/Q mismatch is evident on an ABG, PaCO2 is usually >45 mmHg and PaO2 is usually <60 mmHg
- The V/Q mismatch can lead to pulmonary hypertension and right-sided heart failure called cor pulmonale (Elisha et al., 2023)
- Pulmonary function tests are utilized to diagnose COPD
- Due to difficulty exhaling, the FEV1 and FEV1:FVC ratios are both decreased (Elisha et al., 2023)
- Slowing of expiratory flow and gas trapping are associated with distal airway collapse
- Patients diagnosed with COPD are at a lot higher risk of developing PPCs, which include bronchospasm, atelectasis, pleural effusions, and respiratory failure (Park et al., 2020)
- Patients with COPD have an increased risk of early mortality, ICU admissions, and prolonged length of stay postoperatively (Bustamante et al., 2017)

Figure 2. **Comparison of normal lungs (left) and hyperinflated lungs with possible emphysema (Right)** *(Cleveland Clinic, 2021)*

Implications for Nursing Care

- Ventilation management includes (Elisha et al., 2023):
  1. Maintaining adequate oxygenation by use of pulse oximetry
  2. Eliminating carbon dioxide and monitoring with end-tidal CO2
  3. Avoiding barotrauma from excessive inspiratory pressures
  4. Avoiding alveolar injury from repetitive airway closure and reopening
  5. Avoiding volutrauma from either excessive tidal volume or from auto-PEEP
- Ventilation will require prolonged expiratory time, so the inspiratory: expiratory (I:E ratio) is lower, this can cause higher peak pressures from a shorter inspiratory cycle (Elisha et al., 2023)
- Patients diagnosed with COPD are expected to have prolonged extubation times in PACU (Takeyama et al., 2021)
- Goals of anesthesia postoperatively for patients with COPD include avoidance of PPCs, and studies find that low-tidal volume ventilation, restricting fluid administration, and using sugammadex with extubation have positive patient outcomes (Park et al., 2020)

Conclusion

- COPD is very prevalent in healthcare and has a significant impact on the plan of care and nursing interventions
- COPD can have multiple underlying pathophysiologies including emphysema and chronic bronchitis that can cause inflammation and air trapping
- There are risk factors that increase the incidence of developing COPD including tobacco abuse and exposure to air pollution
- Patients with COPD have difficulty ventilating, and this can lead to acute respiratory failure and cor pulmonale
- PPCs develop at a higher rate in patients with COPD, so nursing care is directed towards lung safety and avoiding barotrauma
- Ventilation settings include prolonged expiratory times and smaller tidal volumes
- PPCs warrant monitoring and prevention to decrease the length of stay in the hospital and improve patient outcomes after surgery

Additional Resources

- Chronic obstructive pulmonary disease (COPD). (2022). *Centers for disease control and prevention.* Retrieved from https://www.cdc.gov/copd/index.html
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