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Asthma Pathophysiology

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Asthma Pathophysiology

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Introduction

- Asthma is a common disease that is prevalent across the world. Asthma affects men, women, and children, and can have major public health consequences including morbidity and mortality (Dharmage et al., 2019).
- It is estimated that around 300 million people worldwide have been diagnosed with Asthma, and by 2025 it is estimated 400 million people will have the disease (Dharmage et al., 2019).
- Asthma is more prevalent in high income countries, however most cases of mortality occur in low income, 3rd world countries (Dharmage et al., 2019).
- Asthma has a significant economic burden on the United States. During the last study done, Asthma accounted for a total cost of \$82 billion. The current-day total cost is estimated to be much higher (Nurmagambetov et al., 2018).
- It is estimated that per-person, the average cost annually for healthcare services by an asthmatic is about \$3,266.

Pathophysiology

- The pathophysiology of Asthma is very complicated. An exacerbation of the disease is usually sparked by factors that can induce airway inflammation leading to airway obstruction and hyperresponsiveness (Gans & Gavrilo, 2020).
- Factors that can cause airway inflammation are allergens, infections, obesity, hormones, tobacco, smoke, exercise, cold air, genetic mutations, and eosinophilia (Gans & Gavrilo, 2020). Other factors known to cause exacerbation are certain chemicals, insecticides, and pesticides (Mattila et al., 2021).
- Chronic irritation and inflammation can cause airway edema, increased mucous production, mucus plugging, and overall airway remodeling from hyperplasia (Gans & Gavrilo, 2020).
- Upregulation and activation of leukocytes are responsible for the heightened immune response. Neutrophils, Eosinophils, and different types of T helper cells direct the immune response of the body (Mattila et al., 2021).

Signs & Symptoms of Exacerbation

Signs and Symptoms of asthma are nonspecific and vary from case to case. Most commonly symptoms include:

- Dyspnea
- Tachypnea
- Inspiratory wheeze
- Expiratory wheeze
- Tachycardia
- Breathing accessory muscle use



	Intermittent	Mild Persistent	Moderate Persistent	Severe Persistent
Symptoms	<2 days/week	<2 days/week but not daily	Daily	Throughout the day
Night Awakenings	<2 days/month	3-4 times/month	>1 time/week but not nightly	Often 7 times/week
Use of SABAs (not for DB)	<2 days/week	>2 days/week but not daily	Daily	Several times per day
Interference w/ Normal activity	None	Minor limitation	Some limitation	Extremely limited
Lung Function	FEV ₁ >80% predicted FEV ₁ /FVC normal	FEV ₁ >80% predicted FEV ₁ /FVC normal	FEV ₁ >60-80% predicted FEV ₁ /FVC normal	FEV ₁ <60% predicted FEV ₁ /FVC reduced >5%

Recommend Step for Initiating Treatment: Step 1, Step 2, Step 3, Steps 4-5

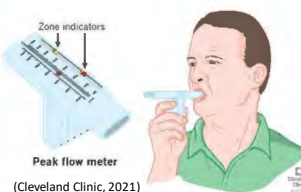
(Asthma Diagnosis Treatment, 2021)

(continued)

- Chest tightness
- Increased mucous production
- Decreased peak flow reading
- Rhinitis
- Sinusitis
- Hypoxia/Hypoxemia
- Pallor/Cyanosis
- Eczema

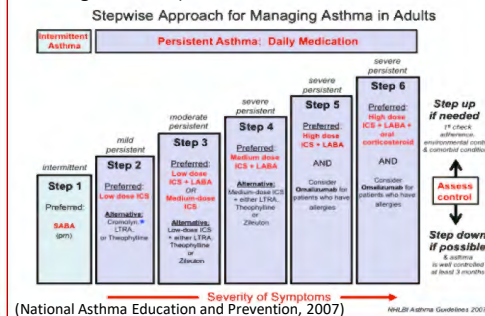
(Wu et al., 2020)

- Peak expiratory flow (PEF) is a simple way to gauge the maximal expiratory flow rate that can be achieved after a full inspiration. The technique is beneficial to monitor for potential asthma exacerbation. After a baseline expiratory flow is achieved, daily measurements are compared to the initial value to assess impending/potential exacerbation (DeVrieze et al., 2020).
- Based on certain measurement criterion, the PEF places the patient into a zone. The Green Zone is PEF of >80% compared to baseline. The Yellow Zone is PEF of 50-80% compared to baseline. The Red Zone is PEF <50% of baseline. Recommendations based on zone are provided by the patient's medical provider. The Red Zone is the most critical and recommends the patient seek medical attention (OSF Healthcare, 2020).



Treatment

- Asthma is a complex heterogeneous disease that varies from patient to patient. Each treatment regimen requires an individualized approach by the provider. Asthma treatment is treated pharmacologically with inhaled medications and behaviorally by modifying potential at risk behaviors (Jones et al., 2018).
- Behavioral modifications for treatment include smoking cessation and avoiding triggers such as harmful allergens, pollens, chemicals, and smoke (Wu et al., 2019).
- Medication interventions include a short-acting beta adrenergic (SABA) rescue inhaler (ex. albuterol) for short term control, a long-acting beta adrenergic (LABA) inhaler (ex. formoterol) for long term control, and an inhaled corticosteroid (ex. budesonide) to complement the LABA for long term management (Ohbayashi et al., 2018).
- A stepwise approach is usually utilized to help manage asthma in adults. Depending on the severity and frequency of symptoms, a medication step tool helps a clinician to prescribe needed medications to prevent exacerbation (National Asthma Education and Prevention Program, 2007).
- All asthma patients are prescribed a short-acting beta adrenergic (SABA) rescue inhaler. Intermittent asthma usually only requires a SABA rescue inhaler. Mild to persistent asthma patients are typically prescribed a low to moderate dose LABA inhaler, as well as low to moderate dose inhaled corticosteroid. Severe persistent asthma patients require high dose LABA inhalers and high dose inhaled corticosteroids (National Asthma Education and Prevention Program, 2007).



Nursing Implications

The Doctorate of Nursing (DNP) prepared nurse plays a vital role in the diagnosis and treatment of asthma. It is important that the nurse recognizes the signs and symptoms that point to acute exacerbation and intervene when indicated.

Nursing Interventions:

- Proper auscultation and identification of breath sounds
- Education of pursed lip breathing technique
- Proper application of supplemental oxygen (Saturation goal >92%)
- Ability to place patient in up-right, high fowlers position
- Education and demonstration of spacer use for inhalers
- Proper administration of SABA/LABA nebulizers and inhalers when indicated
- Education of SABA/LABA nebulizers and inhalers
- Education of corticosteroids and risks of use including thrush
- Education on Green-yellow-red zones and when to see medical attention
- Use of therapeutic communication to alleviate patient concerns and distress

Conclusions

The impact of asthma is far reaching. An in-depth examination of the disease shows that it is important for the DNP prepared nurse to be well versed in diagnosing and managing this disease. Further research is indicated in this field to help better manage the disease and help improve patient outcomes. New research may lead to ways to lessen the economic burden caused by asthma as well.

References



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