Clinical presentation and assessment of asthma – a case study

Asthma is a condition of the respiratory tract, which is mainly characterized by inflammation of the airways and obstruction of airflow. Despite various remedial measures, it is a serious concern as it leads to approximately 4000 deaths each year in the United States alone. It is a multifactorial disease, which can be triggered by a number of reasons and has varied symptoms among patients. Till today, exacerbation of asthma symptoms remains one of the most important causes of visits to the Emergency Department (Lugogo and MacIntyre, 2008).

This paper is a case study based on a patient who visited the Emergency Department with exacerbation of his asthma. The objective of this paper is to understand the clinical presentation of the patient and to analyze the situation for future management. The paper begins with a description of the focus of assessment of the patient, followed by a description of normal parameters and how the patient's symptoms deviate from normal, the tests that need to be performed in order to decide the management strategy of the patient, and a summary of the main issues of the patient and risk factors that could lead to a relapse in the future.

The first step to effective management of Mr. Saunders's condition would be to undertake a detailed assessment of his respiratory system. This should be done based on his history of asthma, shortness of breath, difficulty speaking, high blood pressure, and low oxygen saturation rate. Also, an initial evaluation revealed moderate use of accessory muscles while breathing and widespread respiratory wheeze, and hence, a more detailed assessment of his respiratory system is essential. A high blood pressure coupled with an increased respiratory rate signals immediate treatment. The severity of the asthma attack can be estimated by pulse oximetry. Other assessments that would be helpful to decide the

course of treatment include arterial blood gas values and auscultation of the chest (Adams et al, 2011). It is also important to consider differential diagnoses for Mr. Saunders and they would include Chronic Obstructive Pulmonary Disease (COPD), emphysema, bronchiectasis, cystic fibrosis, allergic bronchopulmonary aspergillosis, and vocal cord dysfunction. These can be ruled out by tests such as evaluation of α-1 antitrypsin levels, presence of airway obstruction or productive cough, serum IgE and IgG levels and skin sensitivity to *Aspergillus* (Long and Fanta, 2012).

The diagnosis of asthma is usually made by identifying any deviation from the normal parameters of respiratory system function. The normal respiratory rate for a man of Mr. Saunders's age is 10 – 14 breaths per minute (Maitre et al, 1995). The normal respiration to pulse ratio is 1:4. In a normal respiratory cycle, the inspiratory phase is slightly shorter than the expiratory phase. There is usually a small gap between two respiration cycles. The movement of the chest is equal, symmetrical and bilateral. Without using a stethoscope, normal breathing is usually quiet. Upon auscultation, normal breath sounds have a low pitch and intensity and sound soft and breezy. Bronchovesicular sounds have a moderate pitch and intensity and bronchial sounds have a high pitch, and are loud and hollow (Moore, 2007).

Based on evaluation of Mr. Saunders's condition, his respiratory rate is 28 breaths per minute, which is moderately higher than normal. This is a common symptom of asthma, as it is characterized by inflammation of the airways and obstruction of airflow. The smooth muscles of the bronchial wall contract quickly upon exposure to an allergen or an irritating agent. This leads to narrowing of the airways resulting in a higher respiratory rate (National Heart, Lung, and Blood Institute, 2007). As per Mr. Saunders's history of asthma, his condition tends to worsen on windy days in the early spring. This is because on these days,

exposure to pollen triggers IgE response. The IgE antibodies attach to the surface of mast cells, which now binds to the allergens. These IgE-mast cell-allergen complexes signal the release of a number of inflammatory mediators such as prostaglandins, histamine and leukotrienes. All these cells migrate into the airways and trigger excessive mucus production. The accumulation of inflammatory cells and mucus in the airways leads to blockage and bronchospasm. This mechanism of hypersensitivity leads to the classic symptoms of asthma experienced by Mr. Saunders such as shortness of breath, use of accessory muscles while breathing and respiratory wheeze upon auscultation (Khachi et al, 2014). As the airways are blocked and insufficient oxygen reaches the lungs, the oxygen saturation rate is also found to be lower than normal as in the case of Mr. Saunders (Hardern, 1996).

Before confirming the diagnosis of asthma for Mr. Saunders, it is important to perform additional confirmatory tests and probe his personal and family history for similar instances. A knowledge of family history of asthma and the severity in other family members can help in determining the prognosis of Mr. Saunders's condition. It is also important to note if there is a history of tobacco usage, obesity, atopy and allergic rhinitis. The length of the expiratory phase should be evaluated. Percussion should be done to identify if the patient has hyperresonance. Cohen's kappa coefficient can also be calculated to evaluate the severity of wheezing. Pulmonary function testing should be done as a confirmatory test for asthma. This includes basic spirometry, and measurement of the peak expiratory flow rate, forced expiratory volume in the first second, maximal mid-expiratory flow rate, and exhaled nitric oxide (Tarasidis and Wilson, 2015). A peak flow rate of less than 30% of the normal value indicates a severe attack. An arterial blood gas should also be measured and should be considered for diagnosis if the PaO_2 is less than 60 mm of mercury. A blood test

should be done to check for leukocytosis and eosinophilia. Serum sodium, potassium, magnesium, and calcium levels should be evaluated. A chest x-ray should be done and probed for signs of hyperinflated lungs, cardiac failure and pulmonary edema (Suri, 2001).

With all the observations made and the data available, the following problems can be identified that are relevant for Mr. Saunders:

- Inadequate air entry – This is evident from the fact that his respiratory rate is high in an attempt to take in more air into his lungs.
- Inability to speak properly – Due to an exacerbation of his symptoms, he is finding it difficult to speak long sentences.
- High blood pressure – At 140/70, he has a normal diastolic pressure; however, his systolic blood pressure is high and needs attention.
- Borderline hypoxemia – He has an oxygen saturation rate of 90% which is indicative of low blood oxygen levels.
- Labored breathing – This can be deduced from the fact that he is moderately using his accessory muscles for breathing.
- Airway obstruction – This is evident from the fact that upon auscultation, widespread respiratory wheezes were heard.

In order to ensure that this kind of relapse does not happen again, the following risk factors relevant to Mr. Saunders's condition need to be kept in mind:

- Hearing impairment and use of hearing aids – Mr. Saunders's moderate hearing loss is a risk factor for relapse of his asthma as it might interfere with his use of inhalers and understanding instructions given by healthcare providers.

- Weather – According to Mr. Saunders's past medical history, his condition is often worse on windy days during the early spring. Hence, unsuitable climatic conditions are a very important risk factor in Mr. Saunders's case (Subbarao et al, 2009).
- Obesity – Although we do not have information of Mr. Saunders's weight, if relevant, obesity is a very important risk factor and studies have shown a strong relationship between obesity and asthma (Subbarao et al, 2009).
- Family history – We also do not have information of Mr. Saunders's relevant family history, but the presence of one or more family members with asthma is a strong risk factor for Mr. Saunders's condition (Subbarao et al, 2009).
- Gender – Studies have shown a strong correlation between gender and percentage of asthma relapse and this is greater for males than for females (Subbarao et al, 2009).
- Exposure to smoke – If Mr. Saunders has a habit of smoking or lives in an environment where he is constantly exposed to smoke, it can be an important risk factor for relapse of his asthma (Traore, 2010).
- Medications – Any use of medications for his hearing loss or high blood pressure such as NSAIDs, beta-blockers, and corticosteroids can act as risk factors for asthma relapse (Sanya et al, 2014).
- Status of physical activity – Lack of physical activity can be an important risk factor for asthma relapse (Traore, 2010).

Asthma is a serious condition of the respiratory system that affects millions of people worldwide each year. This paper aimed to understand the pathophysiology and clinical features of asthma by assessment of a patient who presented to the Emergency Department with exacerbation of his symptoms. A detailed assessment of the respiratory

system and lung function tests need to be undertaken before deciding on the best way to manage asthma symptoms in a patient. The main issues of the patient were listed in order to enable focused management of his symptoms. A list of risk factors for future relapse was also made, so that steps could be taken to avoid an exacerbation of his asthma again.

References

Adams, J. Y., Sutter, M. E., & Albertson, T. E. (2011). The patient with asthma in the Emergency Department. *Clinical Reviews in Allergy & Immunology*. doi:10.1007/s12016-011-8273-z.

Hardern, R. (1996). Oxygen saturation in adults with acute asthma. *Journal of Accident & Emergency Medicine, 13*, 28-30.

Khachi, H., Meynell, H., & Murphy, A. (2014). Asthma: pathophysiology, causes and diagnosis. *Clinical Pharmacist, 6*(9).

Long, A. A., & Fanta, C. H. (2012). Difficult asthma: assessment and management, Part 1. *Allergy & Asthma Proceedings, 33*, 305-312.

Lugogo, N. L., & MacIntyre, N. R. (2008). Life-threatening asthma: pathophysiology and management. *Respiratory Care, 53*(6), 726-735.

Maitre, B., Similowski, T., & Derenne, J-P. (1995). Physical examination of the adult patient with respiratory diseases: inspection and palpation. *European Respiratory Journal, 8*, 1584-1593.

Moore, T. (2007). Respiratory assessment in adults. *Nursing Standard, 21*(49), 48-56.

National Heart, Lung and Blood Institute. (2007). Expert panel report 3: Guidelines for the diagnosis and management of asthma. *National Asthma Education and Prevention Program*. Available from http://www.ncbi.nlm.nih.gov/books/NBK7232/

Sanya, R. E., Kirenga, B. J., Worodria, W., & Okot-Nwang, M. (2014). Risk factors for asthma exacerbation in patients presenting to an emergency unit of a national referral hospital in Kampala, Uganda. *African Health Sciences, 14*(3), 707-715.

Subbarao, P., Becker, A., Brook, J. R., Daley, D., Mandhane, P. J., Miller, G. E., Turvey, S. E., & Sears, M. R. (2009). Epidemiology of asthma: risk factors for development. *Expert Review of Clinical Immunology, 5*(1), 77-95.

Suri, S. (2001). Management of acute severe asthma. *Indian Journal of Allergy, Asthma and Immunology, 15*(1), 35-44.

Tarasidis, G. S., & Wilson, K. F. (2015). Diagnosis of asthma: clinical assessment. *International Forum of Allergy & Rhinology, 5*(S1), S23-S26.

Traore, E. A. (2010). Chapter 3: Asthma risk factors and co-morbidities. *Asthma Burden Report – New Hampshire 2010*. New Hampshire Department of Health and Human Services, Division of Public Health Services, Asthma Control Program.