

## CASE ONE

**Short case number: 3\_7\_1**

**Category: Respiratory System**

**Discipline: Medicine**

**Setting: General Practice**

**Topic: Asthma - exacerbation**

### Case

Martin Fisher, aged 18 years presents acutely short of breath. He has a history of asthma that he has managed with inhaled Ventolin. He states that two times a year he has flare up and he usually requires oral steroids. When asked he states that he does not have an asthma plan. Over the past week he has had a mild 'flu' but he thought he was getting better until this current attack. He has had 4 puffs of Ventolin and doesn't feel any better.

### Questions

1. What further history and examination would you undertake?
2. What investigations are ordered to assess asthma?
3. Summarise the three cardinal pathophysiology features of asthma.
4. Describe how peak flow changes following exposure to an allergen.
5. What is a reversibility test and how is it useful for clinicians?
6. Summarise the concept of the step up and step down management of asthma
7. What are asthma action plans?

### Suggested reading:

Innes JA, Reid PT. Respiratory disease. In: Boon NA et al. Davidson's Principles and Practice of Medicine 20<sup>th</sup> Ed. Churchill Livingstone, London, 2006 PP647-737.

**1. What further history and examination would you take?**

Asthma is characterised by chronic airway inflammation and increased airway hyper-responsiveness leading to symptoms of wheeze, cough, chest tightness and dyspnoea. Asthma is not a uniform disease but a dynamic clinical syndrome with a variety of features. Typical symptoms include recurrent episodes of wheezing, chest tightness, breathlessness and cough. Common precipitants include exercise, particularly in cold weather, exposure to airborne allergens or pollutants, and viral upper respiratory tract infections. Patients with mild intermittent asthma are usually asymptomatic between exacerbations which occur during viral respiratory tract infections or after exposure to allergens. In persistent asthma the pattern is one of chronic wheeze and breathlessness. Asthma characteristically displays a diurnal pattern, with symptoms being worse in the early morning. Particularly when asthma is poorly controlled, symptoms such as cough and wheeze disturb sleep and have led to the use of the term 'nocturnal asthma'. Cough may be the dominant symptom in some patients. Physical examination should include a respiratory examination which includes an assessment of wheeze, respiratory rate, pulse rate, pulse oximetry, blood pressure (pulsus paradoxus), and peak flow. Examine the chest for the use of accessory muscles of respiration, hyper inflated chest, reduced breath sounds and prolonged expiratory phase of respiration.

**2. What investigations are ordered to assess asthma?**

The diagnosis is made on the basis of a compatible history combined with demonstration of variable airflow obstruction.

Investigations include:

- Pulmonary function tests

The measurement of forced expiratory volume over 1 sec ( $FEV_1$ ) and vital capacity (VC) by spirometry allows the demonstration of airflow obstruction, and following the administration of a bronchodilator, confirms the diagnosis when a 15% (and 200 ml) improvement in  $FEV_1$  is noted. Spirometry is also particularly helpful in monitoring the severity of airflow obstruction in patients with impaired lung function.

- Chest x-ray

Radiological examination is generally unhelpful in establishing the diagnosis but may point to alternative diagnoses. Acute asthma is accompanied by hyperinflation, and lobar collapse may be seen if mucus has occluded a large bronchus. Flitting infiltrates, on occasion accompanied by lobar collapse, suggest asthma complicated by allergic bronchopulmonary aspergillosis (ABPA). High resolution CT scan may be useful to detect bronchiectasis.

- Allergy testing

An elevated sputum or peripheral blood eosinophil count may be observed and the serum total IgE is typically elevated in atopic asthma. Skin prick tests are simple and provide a rapid assessment of atopy. Similar information may be provided by the measurement of allergen-specific IgE.

- Induced sputum

Induced sputum and exhaled breath allow the non-invasive assessment of airway inflammation and may prove useful in the diagnosis of asthma and assist in the monitoring of disease activity.

### 3. Summarise the three cardinal pathophysiology features of asthma.

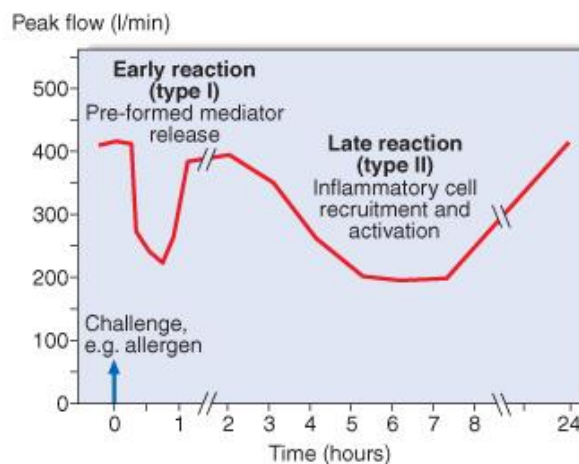
- I. Airflow limitation that reverses spontaneously or with treatment
- II. Airway hyper reactivity characterized by an exaggerated broncho-restriction response to a wide range of non-specific stimuli e.g. exercise, cold air
- III. Airway inflammation characterized by eosinophils, lymphocytes, mast cells, neutrophils; associated oedema, smooth muscle hypertrophy and hyperplasia, thickening of basement membrane, mucous plugging and epithelial damage.

### 4. Describe how peak flow changes following exposure to an allergen.

The inhalation of an allergen in a sensitised atopic asthmatic patient results in a two-phase bronchoconstrictor response.

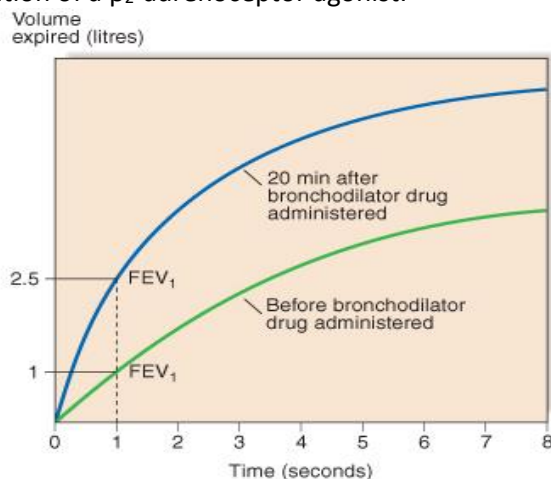
The inhaled allergen rapidly interacts with mucosal mast cells via an IgE-dependent mechanism, resulting in the release of mediators such as histamine and the cysteinyl leukotrienes with resulting bronchoconstriction.

In persistent asthma a chronic and complex inflammatory response ensues, which is characterised by an influx of numerous inflammatory cells, the transformation and participation of airway structural cells, and the secretion of an array of cytokines, chemokines and growth factors.



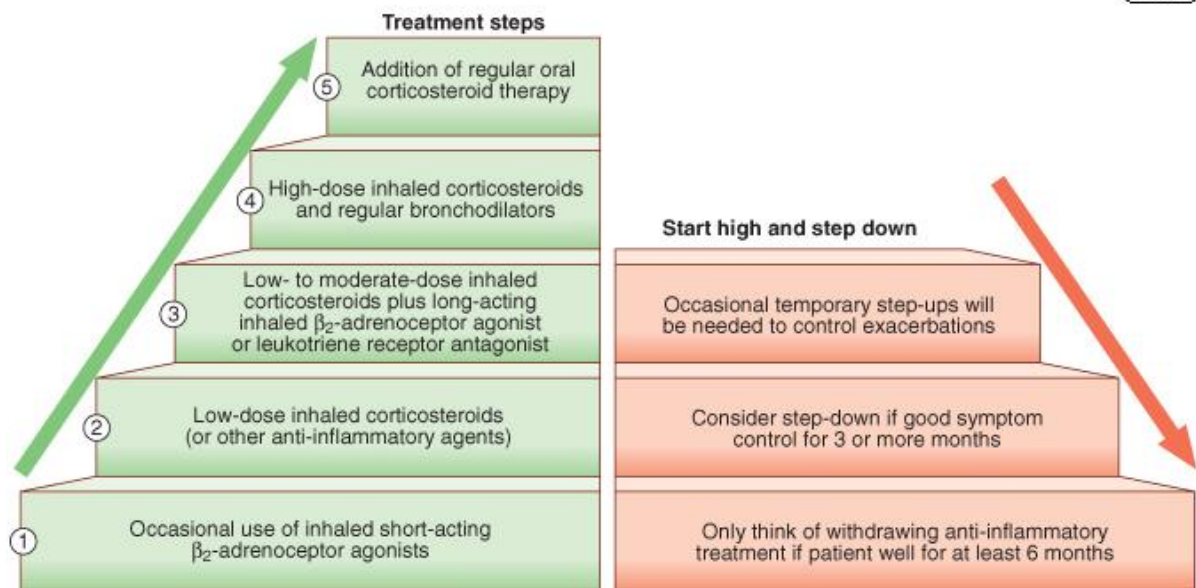
### 5. What is a reversibility test and how is it useful for clinicians?

The reversibility test requires forced expiratory manoeuvres before and 20 minutes after inhalation of a  $\beta_2$ -adrenoceptor agonist.



## 6. Summarise the concept of the step up and step down management of asthma

In the majority of patients with asthma, the disease can be effectively managed in primary care by partnerships between doctors, nurses and, most importantly, patients themselves. The goals of asthma therapy have been endorsed by several sets of guidelines. Management may be directed towards achieving these goals by following a stepwise approach. This concept of step-up and step-down approach is summarised in the diagram below.



## 7. What are asthma action plans?

The variable nature of asthma suggests that encouraging patients to take responsibility for control of their disease should lead to improved clinical outcomes. Patient education should begin at the time of diagnosis and be revisited in subsequent consultations. Patients and their carers need to be taught about the relationship between symptoms and inflammation, the importance of key symptoms such as nocturnal waking, the different types of medication and the use of PEF to guide management decisions. Written action plans may prove helpful in developing these skills.

Suggested reading:

Innes JA, Reid PT. Respiratory disease. In: Boon NA et al. Davidson's Principles and Practice of Medicine 20<sup>th</sup> Ed. Churchill Livingstone, London, 2006 PP647-737.