BY JOHN D. ZOIDIS, MD

PEAK FLOW Monitoring for

Asthma is the most common chronic disease of childhood, affecting some 4.8 million individuals. Peak flow monitoring is essential for assessing its severity so appropriate therapy can begin.

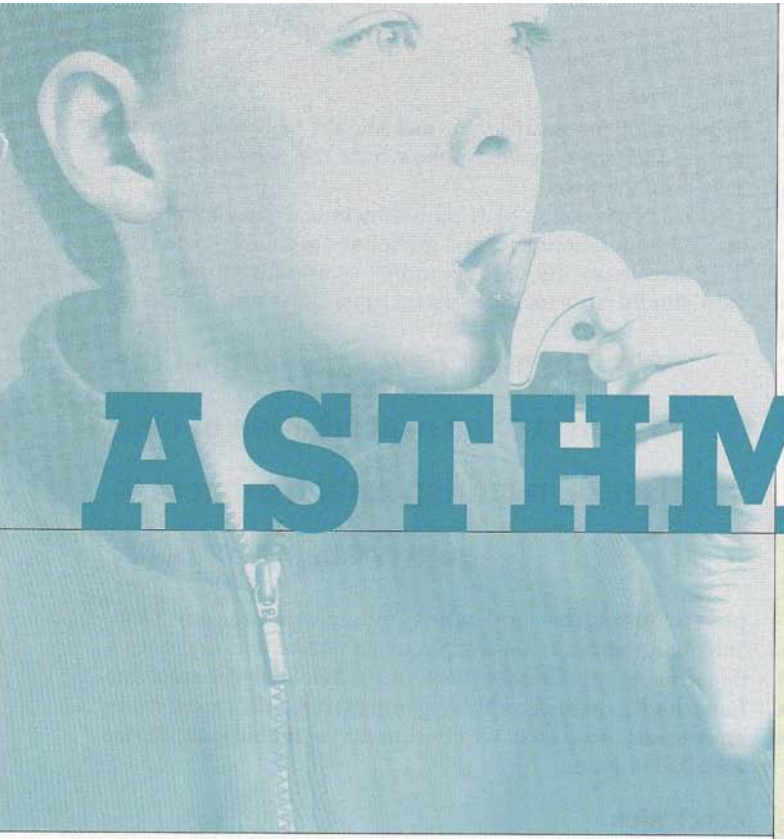
Asthma is a chronic inflammatory disease of the airways characterized by episodic symptoms (such as wheezing, chest tightness, cough, and dyspnea); variable airflow obstruction; and increased bronchial hyperresponsiveness. It is estimated that approximately 15 million people in the United States have asthma.[1] An estimated 4.8 million children have asthma, making it the most common chronic disease of childhood.[2] Despite advances in understanding the pathogenesis of asthma, prevalence and mortality rates for the disease appear to be increasing.[3-6] Potential barriers to care may include nonadherence to the prescribed therapeutic regimen and failure on the part of patients to take regular peak flow measurements. Respiratory clinicians can help in both of these areas by encouraging patients to adhere to their medication plans and emphasizing the importance of daily peak flow monitoring and other pulmonary function tests (PFTs).

PFTs are essential for assessing the severity of asthma so that appropriate therapeutic recommendations can be made. A full battery of PFTs can be performed in the physician's office or respiratory clinic, and peak flow monitoring can be done by the patient at home.

Peak Expiratory Flow Rate Measurement

A spirometer measures lung volumes in order to determine spirometric values, including peak expiratory flow rate (PEFR), forced vital capacity (FVC), forced expiratory volume in 1 second (FEV_1), FEV_1/FVC ratio, and maximum mid-expiratory flow rate. PEFR provides a simple, quantitative measure of airway obstruction. Daily monitoring of PEFR can be used to detect worsening of lung function in the absence of symptoms, to assess variations in lung function throughout the day, to identify triggers, to make appropriate medication decisions, and to monitor the patient's response to therapy. A patient can take PEFR measurements at home, enter the information in a daily diary, and then share the information with the clinician. According to the National Asthma Education and Prevention Program (NAEPP) Expert Panel,[2] clinicians should consider home peak flow monitoring for patients over 5 years old with moderate-to-severe asthma. Spirometry should be performed in the office for patients 45 or more years old who are current or former smokers, for patients who have a prolonged or progressive cough or sputum production, and for those who have a history of exposure to lung irritants.[7]

Optimal PEFR assessment requires some degree of patient education. RTs should inform patients that the key to using a peak flow meter is effort: the patient must



ASTHMA

blow hard. When using the peak flow meter, it is important for the patient to stand up straight and take a deep breath. The patient should be told to blow as hard as possible without bending over, and then to check the number on the indicator scale. These steps should be repeated two or three times, and the largest number measured should be recorded.

Patients should be taught to find their personal-best peak flow number. One way of designating the personal-best peak flow number is to take the highest evening peak flow number the patient can regularly achieve over a period of 1 to 2 weeks when the asthma is under good control. A decrease in peak flow of 20% to 30% of the personal-best number may mean the start of an asthma attack.

Normal values vary considerably according to a person's age, sex, and size. Peak flow measurements are most useful when the patient is able to compare the peak flow obtained on a day-to-day basis. A fall in peak flow, especially when accompanied by symptoms such as increased cough, shortness of breath, or wheezing, may signal the onset of an exacerbation of lung disease, requiring early treatment to prevent complications.

The National Institutes of Health[2] developed a peak flow zone system. The peak flow numbers are placed into zones that are set up like a traffic light. They are designed to help the patient know what to do when his or her peak flow number changes.

The green zone (80% to 100% of the personal-best number) signals all clear. No asthma symptoms are present, and the patient may take his or her medicine as usual.

The yellow zone (50% to 80% of the personal-best number) signals caution. The patient may be having an attack of asthma that requires an inhaled bronchodilator immediately, or an increase in the dosage of other medications. A yellow-zone reading may also mean that the patient's overall control of asthma may not be good, and a change in the medication plan may be warranted.

Lung Volumes

Expiratory Reserve Volume (ERV) is the maximum volume of air exhaled from end-expiration.

Inspiratory Reserve Volume (IRV) is the maximum volume of air inhaled from end-inspiration

Residual Volume (RV) is the volume of air remaining in the lungs after a maximal expiratory effort.

Tidal Volume (VT) is the volume of air inhaled or exhaled during each respiratory cycle.

Spirometric Values

Peak Expiratory Flow Rate (PEFR) is the maximum flow rate that can be generated during a maximal expiratory effort. PEFR is measured in liters per second (L/sec).

Forced Vital Capacity (FVC) is the total volume of air that can be exhaled as rapidly as possible.

Forced Expiratory Volume in 1 Second (FEV_1) is the total volume of air that can be exhaled in 1 second from maximum inspiration.

FEV_1/FVC Ratio is the percentage of the FVC expired in 1 second.

Maximum Mid-Expiratory Flow Rate (MMEF) is the slope of the line between 25% and 75% of the FEV.

The red zone (<50% of the personal-best number) signals a medical alert. The patient should take an inhaled β_2-agonist immediately then call his or her physician if the peak flow number does not return to the yellow or green zone and stay in that zone.

Improving Adherence

Without specific recommendations, patients may adjust or stop medications on their own. The treatment algorithms published by the NAEPP are medically sound, but it can be difficult to adapt them to written instructions that are easy for patients and families to follow. Three elements of the clinician's encounter with patients have been identified as important in the effective management of disease by patients[8]:

- communicating with the patient and family in such a way as to make learning optimal;
- providing an adequate therapeutic regimen; and
- delivering core asthma messages (the basic information needed for patients to understand and act on the regimen prescribed). An example of a core asthma message is the importance of daily peak flow monitoring.

As part of the RT's educational effort, each patient should be given an asthma action plan that outlines the asthma-management program.[9] The action plan should be easy to follow, should be consistent with the patient's personal goals and daily activities, should outline the circumstances that will lower the requirement for medication, and should be a plan that the patient and family agree to follow once the risks and benefits have been discussed.

The asthma action plan should include a diary for recording PEFR measurements and guidelines to follow when peak flow measurements decline and/or symptoms worsen. The plan should also include instructions on when to call the physician's office and when to seek emergency help. Telephone numbers for the physician's office and urgent care department should be written in the booklet. Patients who have had previous rapidly progressive, life-threatening attacks may need to have a hotline to the ambulance service installed at home.

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Conclusion

Periodic assessment and monitoring of asthma symptoms and signs, lung function, and frequency of exacerbations are necessary to ensure that the goals of asthma management are being met. Peak flow monitoring is an important means of providing a quantitative assessment of lung function over time. Respiratory patient education should include the importance of peak flow monitoring and instructions for using the peak flow meter at home. ■

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