Self-Management with Peak Expiratory Flow Monitoring
—Treatment for Bronchial Asthma—

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Abstract:  Peak expiratory flow (PEF) monitoring should be considered in patients with moderate to severe asthma, who are older than 5 years of age, have measurable PEF values, and receive medication on a daily basis. In the practical treatment and management of asthma, the PEF monitoring is most effective in cases where step-wise therapy according to asthma severity is applied in long-term management. The guidelines recommend to determine asthma severity on the basis of symptoms and PEF, and subsequently to select a controller medication for each patient consistent with the severity of the disease. The following two basic strategies are useful for increasing or decreasing the medication dosage: One is the step-up therapy in which treatment is moved to the next step if the disease is not controlled by the current treatment, and the other is the step-down therapy in which the dosage can be reduced if the target of each treatment is achieved and the disease is controlled and confirmed to be stable for at least 3 months. In these strategies, PEF monitoring serves as an important indicator. The guidelines also recommend the ZONE SYSTEM to detect the earliest possible signs of asthma exacerbation and start the use of a reliever medication as early as possible.

Key words:  Peak expiratory flow; Controller; Reliever; Step up; Step down; Zone system

Introduction

The international standardization and unification of the treatment for bronchial asthma have been roughly attained by the guidelines issued in Western countries from the second half of the 1980’s to the first half of the 1990’s, followed by the International Consensus Report (ICR) in 1992 by the National Institute of Health in the U.S.A., and the subsequently...

Although traditionally bronchial asthma had been considered to be a functional disease due to the reversible contraction of bronchial smooth muscles, the concept that bronchial asthma is a chronic inflammatory disease of the airways caused by inflammatory cells such as lymphocytes and eosinophilic leukocytes is currently well established, and it has been demonstrated that inhaled adrenocortical steroids, which are the most potent anti-inflammatory drugs, are the initial drugs of choice to treat the inflammation of the airways in bronchial asthma.

Medications for bronchial asthma can be subdivided broadly into long-term control medications for prevention (controller medications) and medications used on demand in attacks (reliever medications).

Bronchial asthma is a chronic disease that requires the patient’s self-management, the same as high blood pressure and diabetes. Patient education is essential for appropriate self-management.

**Patient Education in the Guidelines**

Although the Japanese guidelines specify patient education and self-management methods in accordance with the GINA and with the addition of original Japan-oriented recommendations, the GINA presents more precise and concrete guidelines on patient education and self-management methods, which are emphasized in this guideline.

Firstly, it is emphasized that education and instructions to patients should be given not only verbally but also in writing. It is worthy of note that this point is emphasized repeatedly even in Western countries where physicians can afford to take enough time when examining a patient, and sufficient communication with the patient is possible. This must be emphasized even more strongly in Japan where physicians have to examine a patient with the least expenditure of time. As is often the case, what the physician considers common sense may not appear as such to patients, and conversely, what a patient considers to be common sense may not appear as such to the physician. In addition to written instructions to each patient prepared by each hospital, booklets distributed by the Japan Allergy Foundation or pharmaceutical companies may be useful.

Secondly, the GINA emphasizes the thorough conduct of self-management with peak expiratory flow (PEF) monitoring. In Japan, a unique asthma diary has been employed as a tool for communication between a patient and a physician and it has been considered very useful. However, the description of symptoms based only on the patient’s subjective perceptions differs occasionally from the objective evaluation in the determination of asthma severity, because a patient gets used to asthma symptoms and the response to low concentrations of oxygen decreases gradually. In the GINA and JGL ’98, it is recommended that a patient should measure PEF several times a day using a PEF meter to evaluate asthma condition objectively. The zone system is set up as an asthma management tool using this PEF monitoring. In this system, PEF monitoring is likened to a traffic signal light in a patient’s self-management plan, and measured PEF values are separated into the green zone (safe zone), yellow zone (caution zone), and red zone (medical warning zone). For each zone, a written instruction about how to use drugs and manage symptoms is given to the individual patient. This is an unequivocal method and easy for patients to understand. In the practical applications of PEF monitoring, however, PEF does not necessarily decrease before the development of subjective symptoms, and there is the problem of how to deal with “patients with consistent low PEF values”, that is, those who have asymptomatic asthma without an increase in PEF.
Thirdly, the guidelines provide detailed instructions about home treatment method for managing exacerbation of asthma. Probably due to the differences in medical care systems and medical insurance systems between Western countries and Japan, physicians in Japan, at least the author, for one, direct patients to take an inhaled $\beta_2$-agonist using a metered dose inhaler (MDI) and an oral $\beta_2$-agonist immediately after an attack occurs, and to come to the hospital as soon as possible, if a few inhalations of $\beta_2$-agonist with MDI did not improve the symptoms; the patients are also instructed to simply come to the hospital whenever they are worried.

In contrast, the instructions in the ICR and GINA place higher priority on the guidance to minimize the number of visits to the hospital. It is also to be noted that these guidelines are in a position to make patients aware of the importance of self-management, probably in relation to their medical care systems. For example, the GINA says that it is important for the successful management of asthma exacerbation to start asthma therapy when a slight sign of a reduction in asthma control is observed, and that the initiation of therapy at home by patients may avoid the delay of treatment and make the patients aware that they can manage their own asthma exacerbation. Furthermore, the straightforward contents of the instructions to patients, including dosing frequencies and dosages stated in figures, is thought to facilitate the understanding by patients.

1. Matters that require attention when performing peak expiratory flow monitoring

Peak expiratory flow monitoring should be considered in patients with moderate to severe asthma, who are older than 5 years of age, have precisely measurable PEF values, and receive medication on a daily basis. Currently, various peak flow meters are available commercially, such as Mini-Wright®, Assess®, Personal Best®, and Vitarograph®. Although there are differences in measurement values among these devices, any device can be used without problems, as long as the same device is used continuously. A patient may select a device easy to use (Fig. 1). Measurement is performed preferably while sitting up or sitting on a chair, and must be carried out in the same position every time.

Peak expiratory flow is, so to speak, the marker of the maximum instantaneous wind speed, which is proportional to the degree of airway occlusion, and is supposed to be correlated with forced expiratory volume in one second. However, quite a few patients who have normal peak expiratory flow values complain of breathlessness as a subjective symptom, since peak expiratory flow indicates only the flow rate in the central airway. In the flow volume curves of such patients, $V_{50}$ and $V_{25}$ are lower, and the constriction and occlusion of peripheral airways are observed occasionally. Thus, it must be understood that peak expiratory flow is not always an all-purpose marker to indicate the state of the airways. As the extent of diurnal variation in peak expiratory flow would serve as a measure of the state of asthma control, measurement twice a day (morning and evening), and before inhalation or oral administration of antiasthmatic drugs is necessary.

To find the personal best value of peak expiratory flow for each patient, it is useful to add two measurements around 11 a.m. and 2 p.m. during the early stage of peak expiratory flow monitoring, when ventilatory function works best in many patients. By making a comparison between peak expiratory flow values before

**Peak Expiratory Flow Monitoring**

Also, the Japanese guidelines (JGL ’98) recommend self-management methods appropriate to the medical circumstances in Japan, while incorporating the points to be learned from the ICR and GINA. This article mentions several matters related to self-management in the treatment for bronchial asthma that require attention, particularly self-management with peak expiratory flow monitoring.
and after the use of bronchodilators such as $\beta_2$-agonists, its reversibility can be known. If peak expiratory flow remains at low values without showing reversibility, this indicates that the current therapy is insufficient and another therapy should be selected. If peak expiratory flow increases significantly, this indicates that the bronchodilator currently used is effective and the long-term management method to maintain the peak expiratory flow value after the use of the bronchodilator should be reconsidered.

2. Significance in long-term management

In cases where step-wise therapy according to asthma severity (see appendix, page 368) is applied in long-term management, the effect of peak expiratory flow monitoring works effectively in the practical treatment and management of asthma. The guidelines recommend to determine asthma severity on the basis of symptoms and PEF, and subsequently to select a long-term management medication (controller medication) depending on the severity.

When PEF is not less than 80% of the personal best value or the predicted value and the daily variability is less than 20%, asthma severity is classified as “Mild Intermittent in STEP 1”; when PEF is 70–80% of the personal best value or the predicted value and the daily variability is 20–30%, it is classified as “Mild Persistent in STEP 2”; when PEF is 60–70% of the personal best value or the predicted value and the daily variability is not less than 30%, it is classified as “Moderate Persistent in STEP 3; and when PEF is not more than 60% of the personal best value or the predicted value and the daily variability is not less than 30%, it is classified as “Severe Persistent in STEP 4”, and the type and dosage of the drug consistent with the degree of severity are specified. The purpose is to allow a patient to perform self-management without visiting on each occasion, by giving to the patient the physician’s instructions on what actions to take at each step.
To increase or decrease the medication dosage, the following two basic strategies are useful: one is the step-up therapy in which treatment is moved to the next step if the disease is not controlled by the current treatment; the other is the step-down therapy in which the dosage is reduced if the target of each treatment can be achieved and the disease is controlled, and confirmed to be stable for at least 3 months. For these strategies, PEF monitoring serves as an important indicator.

3. Zone system (Table 1)

Asthma is a highly variable disease. As has been mentioned, the purpose of the asthma management zone system is to prevent the exacerbation of asthma by having the patient monitor his own asthma state, in order to detect the earliest possible signs of exacerbation and take prompt actions at home.

The Green Zone with a peak expiratory flow value of 80–100% of the personal best value indicates that asthma is controlled well. If this state continues for at least 3 months, a step down in long-term management will be warranted.

The Yellow Zone with a peak expiratory flow value of 50 to 80% of the personal best value signals the presence of an episode of asthma. In this case, it is advisable that an inhaled β2-agonist be taken to relieve the attack quickly and, if the response to the medication is insufficient, an oral steroid previously designated by the physician should be taken before seeing the physician.

The Red Zone with a peak expiratory flow value of less than 50% of the personal best value signals a state in which the symptom of asthma is observed even at resting and affect daily life. In this case, the patient must take an inhaled β2-agonist right away, followed by early administration of an oral steroid. If a rapid improvement of peak expiratory flow cannot be obtained, the patient must see the physician immediately. Administration of oxygen should be initiated, if it is in readiness.

Conclusion

The results of the studies by the Japanese Society of Allergology and the Japanese Respiratory Society have demonstrated that the majority of the causes of deaths due to asthma attacks, numbering 6,000 yearly, are attributed to the delay of appropriate treatment. It is hoped that the widespread use of the zone system, utilizing peak expiratory flow monitoring, would result in prompt and appropriate treatment and reduce deaths due to asthma attacks. The recent significant advances in controller medications and reliever medications have facilitated the control of bronchial asthma markedly.
We, as clinical physicians, want to achieve a better control of bronchial asthma and to improve patient QOL in the clinical setting by providing appropriate treatment and management utilizing various available tools.

REFERENCES