CHAPTER V

APPLICATION OF PEAK EXPIRATORY FLOW METERS FOR THE ASTHMA MANAGEMENT STRATEGY IN IDENTIFIED GROUP OF PATIENTS – 2007 TO 2010

5.1 INTRODUCTION

Many attempts have been made to define asthma in terms of its impact on lung function–that is, airflow limitation, its reversibility, and airway hyper-responsiveness (American Thoracic Society Committee on Diagnostic Standards, 1962). Asthma is a problem worldwide and the disease's social burden and costs to public and private health care systems are substantial. There is good evidence that asthma prevalence has been increasing in many countries, but as yet there are in

sufficient data to determine the likely causes of this increase and of the described variations in and between populations. The existing data on asthma prevalence are derived mainly from developed countries. There are almost no data on the severity of the disease in different populations, nor on the impact of asthma management guidelines. Further studies of the socioeconomic burden of asthma and the cost effectiveness of treatment are needed in both developed and developing countries.

Asthma can begin in adult life in response to sensitizing agents at the workplace and, perhaps, from the development of atopy later in life. Viral infections may still, in adult life, be a trigger of asthma exacerbations, but there is no published evidence that they cause the onset of asthma. The proportion of patients with late-onset asthma that come from the group with past asthma is unknown. In a long-term study of asthma from childhood (Williams and McNicol, 1969 and Martin et.al, 1982). It was found that the more severe the asthma in childhood, the more severe the asthma in adult life, and many of those who "lost" their symptoms continued to have either abnormal lung function or airway hyper-responsiveness. Those with the worst asthma were also the most atopic. While confirmatory studies are required, data from the Nurses Health Study suggest a higher incidence of asthma in postmenopausal women taking estrogen (Troisi *et al.*, 1995). Environmental factors modify the likelihood that asthma will develop in predisposed individuals. These factors include allergens, occupational sensitizers, tobacco smoke, air pollution, respiratory (viral) infections, diet, socioeconomic status, and family size. Some environmental factors can also exacerbate asthma; these are also called precipitating factors.

Triggers are risk factors that cause asthma exacerbations by inducing inflammation or provoking acute bronchoconstriction, or both. Triggers vary from person to person and from time to time. They include further exposures to causal factors (allergens and occupational agents) that have already sensitized the airways of the person with asthma. Triggers also include exercise, cold air, drugs, irritant gases, weather changes, and extreme emotional expression. These triggers cannot cause asthma to develop initially but can exacerbate asthma once it is present. Weather changes are the changes in the meteorological factors which trigger the asthma exacerbations. Adverse weather conditions, such as freezing temperatures, high humidity, and episodes of acute pollution brought on by weather conditions have been associated with asthma exacerbations, but these factors have not been examined systematically and in depth (Khot *et al.*,1988 and Hackney and Linn, 1993) Epidemics of asthma exacerbations associated with thunderstorms may be related to increased concentrations of allergenic particles associated with the downdraft of the storm, which sweeps up pollen grains and particles and concentrates them in a shallow band of air at ground level (Marks *et al*, 2001).

Episodic worsening is a major feature of asthma (Fabbri *et al.*,1998). There are multiple triggers for exacerbations, including stimuli that produce bronchoconstriction only ("inciters"), such as cold air, fog, or exercise, and stimuli that promote airways inflammation ("inducers"), such as exposure to allergens, occupational sensitizers, ozone, or respiratory virus infection (Dolovich and Hargreave, 1981 and Sterk *et al.*,1993). Exercise and hyperventilation with cold and dry air (Strauss *et al.*, 1977) cause bronchoconstriction in asthma by cooling and drying of the airways, leading to the release from airway resident cells and inflammatory cells of mediators such as histamine or cysteinyl leukotrienes, which stimulate smooth muscle contraction (Godfrey and Bar-Yishay 1993). These "inciters" do not worsen bronchial responsiveness to other stimuli, and so have only transient effects and thus making it more cyclic and periodical depending on the weather change.

Self-management plans based on either peak flow or symptoms are of similar efficacy (Turner et al, 1998), so the method of self-monitoring should be tailored to patient skill levels, preferences, and resources. Fundamental to the success of guided self-management is the ability of the patient to recognize deterioration in asthma control. Recommendations for asthma care need to be adapted to local conditions, resources and services. The patient must be taught to assess asthma severity by interpreting key symptoms and performing measurements of peak flow (Thoonen et al., 2003 and Reedel and Barnes 2006). Simple advice to seek medical attention if there are any nighttime symptoms, especially nocturnal wakening, or if symptoms do not respond to increased use of inhaled 2-agonist therapy may be the most important message to convey (Windom *et al.,*,1990 and Spitzer *et al.,*1992). Domiciliary measurements of peak flow, with values interpreted as a percentage of normal predicted or previous best achieved recordings, are used as an objective assessment of the degree of airflow obstruction. Objective measurements are important because studies suggest that many patients are unable to reliably detect changes in their lung function–that is, they cannot correlate their subjective perception of asthma with measurements of lung function such as peak expiratory flow (Kendrick *et al.,* 1993). This diminished perception of lung function changes may correlate with the severity of the underlying asthma (Bij-Hofland *et al.,* 1999) and is associated with an increased risk of death (Barnes, 1994), so peak flow monitoring is particularly important in adults with severe asthma.

Although there is no permanent cure for asthma, the disorder can be adequately controlled with drugs. With treatment, it is quite compatible with a normal life style and span. Under diagnosis and/or inappropriate therapy remain the major cause of asthma morbidity and mortality. The aims of pharmacological management of asthma are: the control of day and night symptoms (including exercise-related symptoms), prevention of exacerbations, and achievement of normal (or near normal) lung function with minimal side effects. Rather than defining a fixed goal for all patients, it would be better to define the best possible goal for an individual patient since individual patients may have different goals and would like to balance these goals against the side-effects of drugs.

According to the research, in many cases the dry air, stormy weather, thunderstorms, pollen grains can all act as the trigger for asthma conditions. Some weather situations like extremely hot or cold temperatures, changes in barometric pressure or humidity, air quality and wind can trigger asthma. In general it has also been found that damp weather conditions also have effect on asthma and trigger symptoms.

It has been also suggested that there are links between asthma attacks and levels of air pollution, particularly ozone, sulphur dioxide and nitrogen dioxide, which is affected by the weather, though the association is controversial.

In addition, extreme weather can amplify, or worsen, the impact of certain other asthma triggers. For instance poor air quality and temperature inversion. Some of the effects of global warming that are related to asthma include increased air pollution. Recently, there has been a focus on the relationship between climate change – what is known as "the greenhouse effect" – and asthma. The gradual warming of our climates worldwide is also believed to be a factor in the explosion of asthma. (Jorres et al., 1996; Beggs and Bambrick, 2005; Confalonieri et al., 2007; Patz and Olson, 2006).

Early treatment of asthma exacerbations is the best strategy for management. Important elements of early treatment at the patient's home includes (EPR–2 1997) Patient education, including a written asthma action plan to guide patient self-management of exacerbations at home, especially for patients who have moderate or severe persistent asthma and any patient who has a history of severe exacerbations. A peak-flow-based plan may be particularly useful for patients who have difficulty perceiving airflow obstruction and worsening asthma. Removal or withdrawal of the environmental factor contributing to the exacerbation. (Jones et al., 1995; Rietveld et al., 1996; Marielle et al., 1999 and Adeniyi and Erhabor, 2011).

Beginning treatment at home avoids treatment delays, prevents exacerbations from becoming severe, and also adds to patients' sense of control over their asthma. The degree of care provided in the home depends on the patients' (or parents') abilities and experience and on the availability of emergency care. Monitoring lung function, by using PEF facilitates early and accurate assessment of exacerbations and response to treatment, to patients and parents of children who have moderate or severe persistent asthma or a history of severe exacerbations and thus helps for best self management. (Kikuchi *et al.,* 1994; Hardie *et al.,* 2002 and Kelly *et al.,* 2002b).

In clinical trials, peak flow values have been used as major outcome measures to monitor both asthma control and treatment responses for short (Lazarus *et al.,* 2001) and long term (Boushey *et al.,* 2005). The relative usefulness of peak flow measurements as monitoring tools can be individualized, based on the patient's age, socioeconomic status (Yoos *et al.,* 2002), asthma pattern, asthma severity (Llewellin *et al.,* 2002), ability to perceive signs and symptoms of early worsening of asthma (Jain *et al.,* 1998), and the clinician's and patient's opinions as to their contribution in achieving and maintaining acceptable asthma control. Advantage at such management is that regular self monitoring helps in regular review of progress by a concerned clinician is the basis for the patient–clinician partnership necessary to achieve asthma control.

Moreover, patients benefit from a written asthma action plan that includes instructions for daily management, and recognizing and handling worsening asthma, including self-adjustment of medications in response to acute symptoms or changes in PEF measures.

Effectiveness of patient education have resulted in positive findings by Marabini *et al.,* 2002; Perneger *et al.,* 2002; Thoonen et. al., 2003; Janson *et al.,* 2003 and Magar *et al.,* 2005 has resulted in reduced symptoms, fewer days of restricted activity, and improvement in quality of life. Self-management education also resulted in improved self-confidence to manage asthma (Perneger *et al.,* 2002; Janson *et al.,* 2003; Magar *et al.,* 2005).

Asthmatic patients can assess asthma severity by monitoring peak expiratory flow (PEF) using a portable device. Previous studies have clearly demonstrated that estimates of the degree of airflow obstruction, whether by asthma patients. (Russel et al, 1986 and Kendrick et al, 1993).

Self management also helps patients to avoid exposure to asthma triggers (allergens and irritants that make their asthma worse), asthma symptoms and attacks can be prevented and medications reduced. Li 1995 in his studies had concluded that peak flow measurement is a simple, inexpensive method of objectively determining airflow obstruction. Use of scenarios to measure asthma knowledge and specifically to assess practical knowledge of self-management of severe asthma (Kolbe, 1996). Patient education and self management plan improves outcome in asthma (Bailey *et al.,* 1990; Wilson *et al.,* 1993 and Trautner *et al.,* 1993;). Peak flow monitoring is effective in improving management of asthma (Woolcock *et al.,* 1988; Parker 1989 and Beasley *et al.,* 1989; Feder *et al.,* 1995; Ignacio-Garcia *et al.,* 1995 and Lahdensuo *et al.,* 1996;).

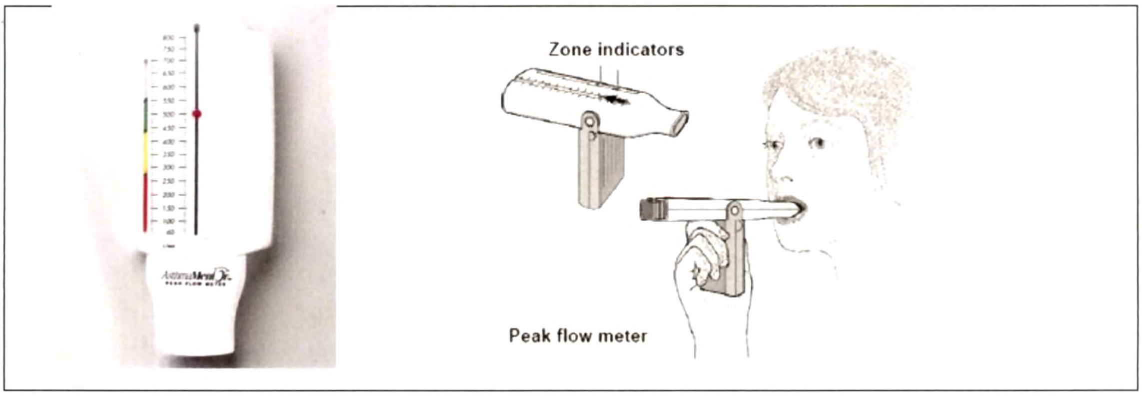
Environmental control can reduce bronchial reactivity (Platts-Mills *et al.,* 1982). Thus peak flow meter is easy to use and handy device for the management. Keeping the above facts in mind the management plan was operated on a trial basis.

5.2 MATERIAL AND METHODS

We provided to all patients a written asthma action plan that included daily management and recognizing and handling changes in PEF measures. A written asthma action plan was particularly recommended for patients who belonged to age group 41 to 50 years in females.

Total forty six patients were selected for asthma management strategy out of which twenty one subjects had dropped out of the study for various reasons and were considered as non-attenders, or group NA. Rest Twenty-five patients with summer asthma exacerbations were enrolled for the management programme. They were the same group of patients who had shown the correlation with the specific environment. These remaining 25 patients took part in an asthma education program including an action plan based on PEF monitoring and were asked to measure their PEF morning and evening; they were given a peak flow meter and a diary card. Patients involved in the study were then taken for the individualized asthma management strategy which included an hour session wherein they were instructed to adjust the treatment according to their PEF values. At each follow-up visit, reinforcement regarding the usefulness of PEF monitoring was given. The specialized physician also reviewed the diary card to check whether the patient had increased his asthma medication when PEF dropped.

Fig. no. 5.1: Peak Flow Meter



During a 1-year randomized prospective study, participants were asked to measure morning and evening PEF throughout the year. The best of the three consecutive measurements of PEF values had to be recorded in their diaries. They all participated in an individualized asthma education program that covered the following issues of asthma triggers, criteria of good asthma control, usefulness of PEF monitoring, and management of asthma exacerbations according to PEF values. A patient's best peak expiratory flow was determined by use of the peak flow meter twice daily when the patient's lung function was at its best. From that baseline, the patient's 'zones' were then determined as Green Zone - 80 - 100 % of patient's personal best PEF, Yellow Zone - 50 - 80 % of patient's personal best PEF and Red Zone - less than 50 % of patient's personal best PEF. Once the individual patient's zones were defined, they were instructed on actions to take for each zone.

5.3 RESULTS AND DISCUSSIONS

The purpose of periodic assessment and self management is to determine whether the asthma management strategy is useful in controlling asthma. When asthma is not controlled, it is associated with significant asthma burden (Fuhlbrigge *et al.,* 2002), decreased quality of life (Schatz *et al.,* 2005b), and increased health care utilization (Vollmer *et al.,* 2002 and Schatz *et al.,* 2005a). The level of asthma control is the degree to which both dimensions of the manifestations of asthma—impairment and risk—are minimized by therapeutic intervention. A recent study by Bateman *et al.,* (2004) demonstrated that significant reductions in the rate of severe exacerbations and improvements in quality of life were achieved by aiming at achieving guideline-defined asthma control and by adjusting therapy to achieve it.

In clinical practice peak flow values have been used as major outcome measures to monitor both asthma control and treatment responses, short (Lazarus *et al.,* 2001) and long term (Boushey *et al.,* 2005). Although peak flow monitoring to guide chronic asthma management has been reported to be valuable in studies more reflective of clinical practice, the results are not consistent enough for this tool to be recommended uniformly for all asthma patients (Jain *et al.,* 1998). Thus, the relative usefulness of peak flow measurements as monitoring tools can be individualized, based on the patient's age, socioeconomic status (Yoos *et al.,* 2002), asthma pattern, asthma severity (Llewellin *et al.,* 2002), ability to perceive signs and symptoms of early worsening of asthma (Jain *et al.,* 1998), and the clinician's and patient's opinions as to their contribution in achieving and maintaining acceptable asthma control.

PEF measures could also be used to help diagnose asthma, assess the influence of environmental factors on asthma, and document changes in asthma therapy. Along with the peak flow meters we provided the selected group of patients with a written asthma action plan that included instructions for daily management and recognizing; handling worsening of asthma along with changes in PEF measures. They were appraised on how to monitor signs and symptoms so they can recognize early signs of deterioration and take appropriate action, particularly since many fatal asthma exacerbations occur out of hospital (Krishnan *et al.,* 2006). They were taught by the physicians how to adjust their medications early in an exacerbation (Kelly *et al.,* 2002b) and when to call for further help or seek medical care. They were asked to opt for medical help earlier if the exacerbation was severe; treatment did not give rapid, sustained improvement; or there was further deterioration. In our study, even though patients were instructed in why to use peak flow meters and how to use them properly, their compliance with monitoring was not optimal. Throughout the study period, the average compliance of the patients with PEF record maintenance decreased from 71% of measurements at 1st month, to 58% at 6th month and finally to 30% at 12th month. When compared with a usual care group, the experimental group showed improvement in compliance and reductions in asthma exacerbations and visits to chest physicians. At the end of 1 year, 26% of the patients achieved total control on their asthma exacerbations (i.e., the absence of any sign or symptom of asthma), and 52% had achieved well controlled asthma.

Hence, the study showed that short-term compliance with PEF monitoring was fairly good, although one third of the subjects did not comply right from the start despite having been given specific information on the usefulness of the portable device in the management of their asthma.

Our results suggest that recommendations about PEF monitoring and interpretation should be made in order to individuals' needs and degree of motivation. For those involved in asthma care, PEF monitoring seems a most interesting method to monitor asthma, although patients may not share eagerness for PEF monitoring. This suggests that the usefulness of peak flow meters given without any education would be very limited indeed. However, our results did not support this hypothesis, although the number of subjects who were given the peak flow meter was small. More studies need to be done with regard to this issue, but it suggests that behaviors such as objectively measuring airflow obstruction by regular PEF monitoring may be difficult to acquire, even with high-quality asthma education.

Hence, we recommend that as an asthmatic one should avoid or risk less exposure to the fumes from the petrol and diesel vehicles, and smoke, particularly during weather and climate changes. Furthermore,, weather conditions and change in weather can affect them and in turn worsen asthmatic conditions.