

Investigating the Challenges Faced in Asthma Management, a Tertiary Care Center Experience

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Received: June 21, 2019; **Published:** August 20, 2019

Abstract

Background: Asthma is a chronic inflammatory disease with a significant socioeconomic impact on patients and their families. Uncontrolled asthma is associated with an impaired quality of life as well as increased expenditure on healthcare. Optimal care necessitates not just an appropriate prescription, but also compliance with therapy and correct inhaler technique. We conducted a study to assess the challenges of asthma management in the outpatient setting in a developing country.

Objectives: To study management of asthma in a chest clinic at a teaching hospital in Karachi, Pakistan.

Methods: Prospective cross-sectional survey; All subjects underwent a questionnaire-based interview, review of their medical records and direct observation of inhaler technique.

Results: 202 patients were recruited. Mean age \pm SD was 49.41 ± 17.9 years. Nearly half ($n = 106, 52\%$) of the study population were female. More than one third ($n = 79, 39\%$) of the patients reported being non-compliant with their medication in the preceding six weeks. Most common reasons for non-compliance were reported to be "feeling better" ($n = 32, 17\%$) and "forgetfulness" ($n = 23, 11\%$). Less than a third ($n = 59, 29\%$) were able to demonstrate the correct use of an MDI. Nearly half ($n = 104, 52\%$) of the patients had been prescribed a spacer and a slightly larger proportion ($n = 37, 40\%$) was able to use the Spacer+MDI combination correctly as opposed to an MDI alone. Addition of a spacer was however responsible for an increased non-compliance rate (47%). Age, gender or prior inhaler teaching had no significant impact on MDI technique. A large majority ($n = 178, 88\%$) were prescribed inhaled steroids (ICS) with no age or gender discrimination.

Conclusion: Nearly half of all participants reported being non-compliant with therapy. A third of our study population was found to be using the MDIs correctly, with a slightly larger proportion using the MDI+spacer combination as advised. ICS had been prescribed to the vast majority of the patients and fewer patients were found to have been prescribed SABA as compared to previous studies. Patient education and training in the use of asthma medication require strengthening and the importance of using medication as prescribed needs to be reinforced. Inhaler technique needs to be assessed periodically.

Keywords: Asthma; Metered Dose Inhaler; Chronic Obstructive Pulmonary Disease

Abbreviations

MDI: Metered Dose Inhaler; ICS: Inhaled Corticosteroids; SABA: Short Acting Beta Agonist; LABA: Long Acting Beta Agonist; CFC: Chloro-fluorocarbon; DPI: Dry Powder Inhalers; COPD: Chronic Obstructive Pulmonary Disease

Introduction

Asthma is a chronic inflammatory condition characterized by airway hyper-responsiveness leading to reversible airway obstruction [1]. As a chronic lung condition, it has a considerable impact on patient quality of life, with effects ranging from mild functional limitation to significant morbidity leading to prolonged hospitalizations. Due to its prolonged and far reaching effects on all aspects of the patient's life, asthma is ranked 16th among the leading causes of years lived with disability and 28th among the leading causes of burden of disease [2].

Despite remarkable improvements in pharmacologic therapy, asthma management has remained a major challenge in developing countries where in addition to the rising level of pollutants, long term adherence to therapy and treatment fatigue have presented significant barriers to optimal health care [3].

Published guidelines recommend inhaled medications as the first choice for asthma treatment because they allow for a smaller dose of the drug to be deposited directly into the lung resulting in a rapid onset of action [3,4]. However, effective drug delivery is contingent on correct inhaler technique [5]. Previous authors have reported the prevalence of sub-optimal technique with metered-dose inhalers (MDIs) and dry-powder inhalers to be as high as 45%, resulting in reduced efficacy and an increase in adverse effects both of which ultimately lead to an increase in the number of emergency department visits [6-8].

Inhaler efficacy can be enhanced by the use of a spacer device. By allowing the medication to be held in the chamber long enough for patients to inhale slowly and deeply, a spacer effectively mitigates poor coordination between actuation and inhalation. This eliminates oral deposition of the medication, otherwise thought to be as high as 80% of the inhaled dose, increasing the efficiency of the inhaler [8].

The ultimate aim of asthma therapy is to achieve disease control along with minimal side effects and cost. These outcomes can only be achieved with appropriate prescription, therapeutic compliance on part of the patients and the correct use of inhalers. A shortfall in any one of these aspects of care results in suboptimal symptom control and can potentially initiate a vicious cascade of effects that may further compromise adherence to therapy.

In our study, we aim to explore the challenges faced by patients suffering from asthma in a developing country such as Pakistan, as well as the prevalence of poor inhaler technique and non-compliance with therapy. We also aim to identify commonly reported reasons for non-compliance with therapy so that effective strategies can be developed to eliminate them and ensure long term adherence to therapy, which would result in better quality of life for the individuals suffering from this chronic debilitating condition.

Materials and Methods

This prospective cross-sectional study was conducted at the Chest clinic of Aga Khan University Hospital (AKUH), Karachi, Pakistan. AKUH is a tertiary care center, located in the city of Karachi. Although the patient population attending our facility primarily comprises of middle/upper income-class groups of the city, referrals are seen from health care centers across the country. The chest clinic which is conducted six days a week is staffed by six full time and four part-time consultant respiratory physicians with approximately fourteen thousand patients attending the clinic each year. Most of our patients pay out-of-pocket for consultation with the physician as well as the medications. Approval for this Research Protocol was obtained from The Ethical review committee of AKUH.

Our study population included patients who were at least 12 years of age, using MDIs with or without a spacer for 6 or more weeks and formally diagnosed with Asthma by a consultant respiratory physician. Recruitment of study participants lasted for six months. Following an outpatient consultation with the specialist, a trained junior doctor or respiratory nurse specialist invited patients to visit an adjoining room to participate in a structured questionnaire based face-to-face interview and undergo inhaler technique assessment with either an MDI alone or a combination of MDI and spacer if prescribed. For patients with multiple follow-ups during the study period, the first visit was used for inclusion/analysis.

The study questionnaire consisted of two parts. The first part focused on patient demographics, duration of illness, duration of inhaler use, prior formal inhaler teaching as well as medication being taken up until that particular hospital visit. The second part was related to a set of self-reported questions regarding adherence to prescribed regimen over the preceding 6 weeks and included the following questions; “Have you taken all your inhaler medications in the last six weeks?”, “If no, how often did you miss your medication?” with available options “daily”, “once a week”, “more than once a week”, “Why did you miss your medication?” with available options “side effects”, “forgetfulness”, “cost”, “improved symptoms”, “concern about addiction”, “Do you feel you are using the inhaler correctly?” and “Do you see any mist escaping when you use your inhaler?”

An assessment of the inhalation technique was performed by asking the patients to take 2 puffs of an MDI alone or an MDI using a spacer for those who had been prescribed one, while being observed by the researcher. Inhalation technique of the study participants was evaluated based (Table 1) on the recommendations by the National Institutes of Health review committee for the treatment of asthma [9].

<p>MDI without spacer (8 steps)</p> <ol style="list-style-type: none"> 1. Shake canister 2. Hold canister upright at opening of mouth 3. Begin a slow breath 4. Actuate the MDI once 5. Continue slow breath 6. Inhale to total lung capacity 7. Hold breath for at least 4 seconds 8. Wait at least 30 seconds before next actuation <p>MDI with spacer (7 steps)</p> <ol style="list-style-type: none"> 1. Shake canister 2. Hold canister upright with spacer in mouth 3. Actuate the MDI once 4. Take a slow breath 5. Inhale to total lung capacity 6. Hold breath for at least 4 seconds 7. Wait at least 30 seconds before next actuation

Table 1: Stepwise use of a MDI with or without a spacer.

For study purposes, the following were considered to be asthma medications: inhaled short-acting beta2-agonists (SABA), oral short-acting beta2-agonists, inhaled long-acting beta2-agonists (LABA), inhaled corticosteroids (ICS), inhaled anticholinergics, methylxanthines, leukotriene receptor antagonist and oral steroids. In case of combination therapy, each active ingredient was counted separately.

Statistical methods

Analyses were performed using the Statistical Package for Social Sciences (SPSS) version 19 (Chicago, IL, USA). A descriptive analysis was performed for the demographic profile. Results were presented as the Mean ± Standard deviation for quantitative variables and a number (percentages) for qualitative variables (gender, co-morbid conditions, drugs). Univariate and multilevel regression models were used to explain variability in prescribing, self-reported compliance and inhaler technique with age, gender, prior inhaler teaching or the number of prescribed medications. All p-values were two-sided and considered statistically significant if < 0.05.

Results

During the study period, 202 patients with asthma were studied prospectively. Mean age ± SD of the study participants was 49.41 ± 17.9 years. Nearly half of all subjects were female (n = 106, 53%) and a large majority (n = 179, 88%) hailed from urban areas. Around one-tenth (n = 24, 11%) were found to be current smokers and slightly more than a quarter (n = 51, 29%) of the participants reported exposure to passive smoking. 107 (53%) patients reported having had asthma for > 4 years, 59 (29%) between 1 - 4 years and slightly less than a fifth (n = 36, 18%) reported having had Asthma for < 1 year (Table 2). Only 41 (20%) participants reported having pets at home, which mostly included dogs.

Mean age (years ± SD)	49.4 ± 17.9
Gender - no. (%)	
Male	96 (47)
Female	106 (53)
Duration of illness in years - no. (%)	
< 1	
1 - 4	36 (18)
> 4	59 (29)
	107 (53)
Smoking status - no. (%)	
Current smoker	24 (11)
Ex-smoker	42 (21)
Never smoker	136 (68)
Passive smoker	51 (29)
Residence - no. (%)	
Urban	179 (88)
Rural	23 (12)
Inhaler use in months - no. (%)	
< 6	
6 - 12	35 (17)
> 12	34 (17)
	133 (66)
Pets at home - no. (%)	41 (20)
MDI prescription - no. (%)	
Without a spacer	104 (52)
With a spacer	98 (48)
Non-compliance (self-reported) - no. (%)	
With medications	79 (39)
With spacer	37 (37)

Table 2: Baseline characteristics of asthma patients.

Less than one-third of the (n = 59, 29%) patients were able to correctly use an inhaler device with (n = 37, 40%) and without a spacer (n = 22, 22%) respectively. Of the 168(83%) participants who had previously received formal teaching, only 49 (29%) could perform all the steps correctly. Approximately half the cohort (n = 97, 48%) had been prescribed a spacer with their inhaler and a larger proportion of these individuals was able to demonstrate the correct use of the combination compared to those prescribed a simple MDI i.e. 40% vs. 22% respectively, which was found to be statistically significant (p < 0.05) (Figure 1). However, less than two thirds (n = 61, 60%) of the study participants reported the frequency of spacer use as ‘every time’.

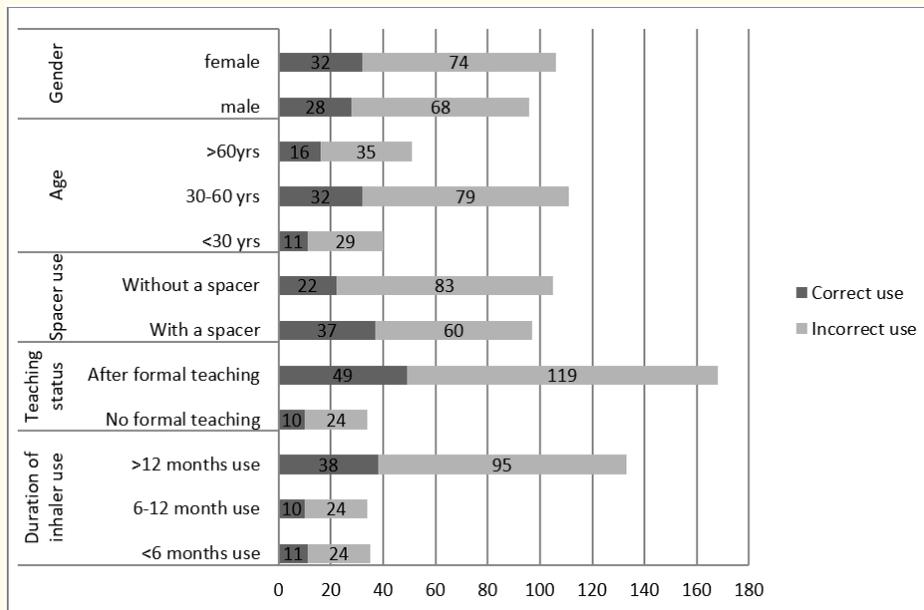


Figure 1: Distribution of inhaler technique according to gender, age, spacer use, teaching status and duration of inhaler use (N = 202).

Even though nearly three quarters (n = 143, 70.8%) of the patients perceived their technique to be ‘satisfactory’, a major proportion of these individuals (n = 100, 69.9%) did admit seeing fumes when using the inhaler. When using an MDI without a spacer, the three steps where mistakes were made most frequently were found to be; „begin a slow breath” (n = 49, 47%), “waiting 30 seconds before next actuation” (n = 44, 46%) and „hold breath ≥ 4 sec” (n = 41, 42%) (Figure 2). Whereas, when using an MDI with a spacer, the three most frequently identified mistakes were “hold breath ≥ 4 sec” (n = 42, 41%), “waiting 30 seconds before next actuation” (n = 41, 40%) and “actuate the MDI once” (n = 35, 34%) (Figure 3).

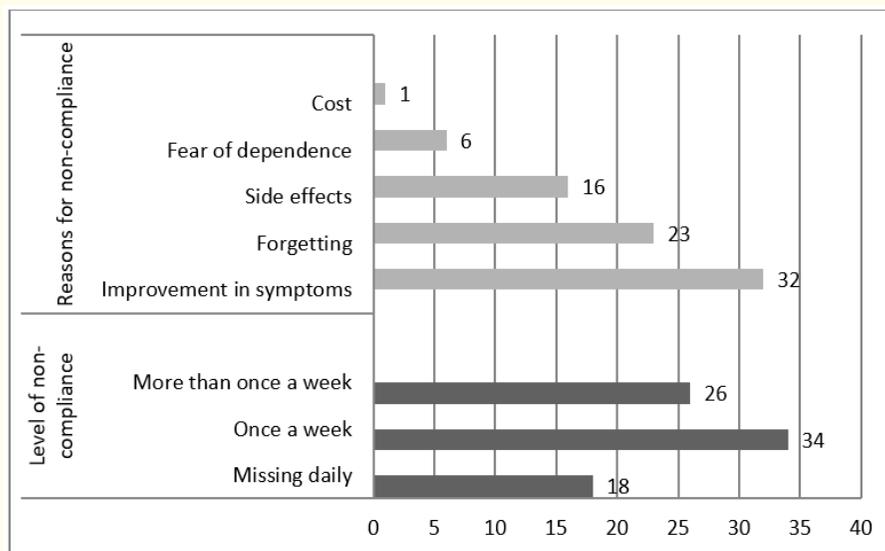


Figure 2: Reasons and level of non-compliance in previous 6 weeks with treatment (N = 202).

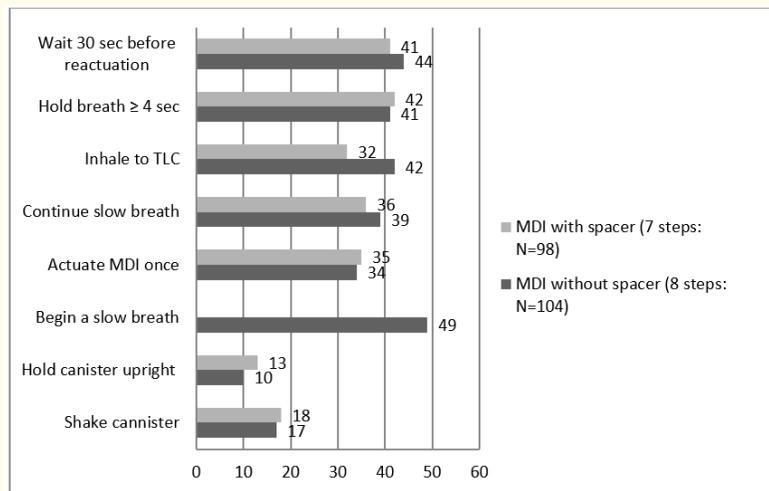


Figure 3: Stepwise errors in inhaler technique.

More than one-third (n = 78, 39%) of the cohort self-reported being non-compliant with inhaler use in the last six weeks (Table 1). Of these, 18 (9%) reported missing them daily, 34 (17%) once a week and 26 (13%) more than once a week (Figure 2). Reasons for not taking their medication regularly were cited as (Figure 2) improvement in symptoms (n = 32, 16%), forgetting (n = 23, 11%), side-effects (n = 16, 8%) fear of dependence (n = 6, 3%) and cost (n = 1, 0.5%). Age, gender, number of prescribed drugs or prior inhaler teaching did not predict non-compliance.

The three most commonly prescribed drugs were salbutamol (n = 124, 61%), salmeterol/fluticasone combination (n = 112, 55%) and beclomethasone (n = 52, 26%) respectively. Two-thirds (n = 133, 66%) of the patients had been using inhalers for >12 months (Table 1). Inhaled corticosteroids (ICS) were prescribed in a large majority (n = 178, 88%) with no age or gender discrimination (Table 3). Approximately a third were on single (n = 70, 35%) and dual (n = 74, 37%) drug therapy each, while only 11 (5%) of the patients were found to be taking 4 or more drugs (Table 3). Around two-thirds (n = 129, 64%) of patients said they would discuss their medication only with the doctor, with an additional 50 (25%) who were happy to discuss it with their nurse as well. Only 23 (10%) patients reported being comfortable discussing their therapy with anyone else, including the shopkeeper/pharmacist.

Treatment	12-30 yrs (n = 39, 17%) No. (%)	>30-60 yrs (n = 111, 57%) No. (%)	>60 yrs (n = 52, 26%) No. (%)	Total (n = 202) No. (%)
Salbutamol	26 (21)	66 (53)	32 (26)	124 (61)
Beclomethasone	11 (21)	31 (60)	10 (19)	52 (26)
Ipratropium	3 (8)	13 (36)	21 (56)	37 (18)
Salmeterol	2 (33)	3 (50)	1 (27)	6 (3)
Salmeterol + Fluticasone	18 (16)	60 (53)	34 (31)	112 (55)
Salbutamol + beclomethasone	4 (28)	10 (72)	0	14 (7)
Montelukast	4 (28)	7 (50)	3 (22)	14 (7)
Theophylline	0	10 (67)	5 (33)	15 (7)
Oral Steroids	3 (15)	9 (45)	8 (40)	20 (10)
Oral beta 2 agonists	0	0	0	0
Monotherapy	15 (21)	42 (60)	13 (19)	70 (35)
Two-drug combination	12 (16)	41 (55)	21 (29)	74 (37)
Three-drug combination	11 (23)	20 (42)	16 (35)	47 (23)
Four or more drug combination	1 (10)	8 (72)	2 (12)	11 (5)

Table 3: Asthma therapy by age group.

Discussion

Inhaled therapy remains the most effective and important aspect of asthma maintenance treatment for patients of all ages [4,5]. The therapeutic benefit of this mode of delivery is dependent on sufficient deposition of medication in the medium-sized and smaller airways, which is largely determined by a competent inhaler technique and holds true for inhalers of all designs and complexities [10]. Globally there are variations in prescribing practices for asthma and these have been ascribed to differences in the case mix of patients, socioeconomic factors, and availability of different inhaler and spacer devices locally [11]. At the time of this study simple MDIs were the only type of devices officially marketed in Pakistan and majority of them were not CFC-free.

Guidelines for the management of asthma stress the use of therapy with inhaled corticosteroids for disease control [12,13]. Treatment algorithms emphasize chronic maintenance therapy over acute episodic care and emphasize the need for its daily use in an effort to decrease morbidity and mortality rates [14]. In our study, encouragingly a large majority ($n = 178$, 88%) of the patients were found to have been prescribed an inhaled corticosteroid. However, only about two-thirds of these patients ($n = 101$, 67%) reported using them regularly. In contrast to previous studies, a short-acting beta₂ agonist inhaler ($n = 124$, 60%) or its combination with a corticosteroid ($n = 14$, 7%) was found to have been prescribed less frequently (Table 3) [15]. This, we believe is primarily due to the easy availability of nebulizers and nebulized medications. Access to nebulized reliever medication often eliminates the need for patients to seek emergency medical care in the event of an exacerbation, reducing their health related costs. Alarming however, only 14% of the patients who had been prescribed inhaled SABA's were found to be using them on an as needed basis, while a significant proportion of the patients prescribed SABAs reported having been advised to use them between once a day to every 6 hours ($n = 119$, 86%). The regular and continued use of this class of medications has in past raised concerns about an associated unrecognized decrease in their efficacy and a potential delay in seeking medical attention during periods of exacerbation, both of which lead to adverse health outcomes and extended hospital stays [14].

As with any chronic disease, patient compliance is an important determinant of therapeutic success. Haynes and Sackett defined compliance more than three decades ago as "the extent to which a person's behavior (in terms of taking medications, following diets, or executing lifestyle changes) coincides with medical or health advice" [16]. Creer, *et al.* divided factors that correlated with non-compliance into four categories: patient variables, interactions between physician or medical staff and patients or family, medication characteristics, and nature of asthma [17]. Additionally, Cochrane described several patterns of noncompliance including taking only half of the medications at the prescribed times, taking regularly for a period and stopping, and skipping prescribed doses [18]. In line with previously published data, more than a third of our patients ($n = 79$, 39%) reported not being compliant with their medication in the preceding six weeks. Commonly reported reasons for non-compliance included improved symptom control and simply forgetting (Figure 2). Noncompliance was found to be significantly higher in women ($n = 46$, 58%) as compared to men ($n = 33$, 41%). We believe that both these findings reflect the importance of asthma education in predicting compliance to the prescribed medication regimen. Patients who have been educated regarding the natural history of the disease are less likely to cease controller inhaler therapy, simply because of improved symptoms. To this day, female patients continue to have limited access to healthcare professionals in most parts of the city, and thus have barely been educated about asthma, beyond what they have learnt from their male counterparts or other patients.

With respect to spacer use, more than a third of the patients admitted ($n = 37$, 38%) not using it every time. Nearly half of these patients ($n = 16$) also reported being non-compliant with both the medications and the spacer device. Therefore, the prescription of a spacer device to our cohort increased the total combined non-compliance rate to a worrisome 47% ($n = 95$).

Previous studies have reported a high rate of incorrect inhaler technique with MDIs and dry-powder inhalers (DPIs) [6]. In our study, 71% of the patients demonstrated an incorrect inhaler technique. Although no significant association was identified between the prevalence of poor technique and the variables age, gender, previous inhaler teaching and length of inhaler use (Figure 1), the use of a spacer with the inhaler was found to be associated with a significantly lower rate of poor technique, which reinforces the role of spacers in patient populations such as ours, who may find it difficult to administer the inhaler correctly otherwise. Unfortunately, though only about two-thirds ($n = 60$, 61%) of the patients admitted using the spacer every time they used the inhaler, with approximately one fifth using it "occasionally" ($n = 19$, 19%). Similar to earlier published data, incorrect slow inhalation technique was the most common mistake ($n = 49$, 47%) made by patients using a simple MDI [19]. With the MDI+spacer combination, "holding breath at maximum inspiration" ($n = 42$, 43%) was the most frequently identified error (Figure 3).

Poor inhaler technique coupled with an inability to identify incorrect use can negatively impact patient compliance by causing them to incorrectly label their medications as ineffective and discontinuing treatment altogether [5]. In our study, more than two-thirds ($n = 143$, 70%) of the patients perceived their inhaler technique to be satisfactory, but nearly three fourth ($n = 100$, 71%) of these also admitted to regularly observing fumes leaking around the inhaler during use. Interestingly, prior inhaler teaching showed no significant correlation with self-assessment of inhaler use or reporting of fumes escaping on use, implying poor retention of previous training and reinforcing the recommendations of previous studies that suggest regularly revisiting inhaler techniques with patients dependent on inhalers [5]. It is equally important to periodically evaluate the inhaler techniques of healthcare providers who have been entrusted with the task of educating the patients, and retraining them if necessary, as previous studies have shown an increase in inpatients having their inhaler technique assessed and corrected, following such interventions [20]. Patients with better knowledge and skills are likely to be much more confident and willing to undertake inhaler technique education to patients [21].

Our study has several limitations. Firstly, although the collection of data was standardized, some of it was based on self-reporting and thus a recall bias exists for such variables. In addition, a more detailed review of the patients' educational background could have allowed us to investigate the association between literacy and poor retention of inhaler technique. Among the reasons for non-compliance, further inquiring into the patients' knowledge and perceptions of medication side effects could have helped identify misconceptions so that these may be targeted in particular, as part of asthma education sessions. Also, since the data collected was primarily pertaining to asthma and did not take into account co-morbid conditions, patient reporting may have been affected. For instance, given that a quarter of our patients were current or ex-smokers, a possibility of concomitant COPD exists, but we believe that this would not impact our overall conclusions. Lastly, this was a single center experience and may not be generalizable to other institutions.

Conclusions

Asthma is a lifelong condition for most patients, and patients can only manage such an illness if they are familiar with it. Management of asthma requires a partnership between the patient and the healthcare provider, whereby the patient is involved in the decision making regarding his/her medication regimen. Educating the patient is imperative in maintaining and strengthening this partnership, not just about the medication, but the disease itself. Where needed, patients should also be encouraged to seek re-training of inhaler technique if they do not feel comfortable using it.

Summary

Nearly half of our patients reported non-compliance to prescribed therapy. The most frequently reported reason for non-compliance was an improvement in symptoms. Age, gender or the number of inhalers prescribed did not predict non-compliance. ICS and SABA were the most frequently prescribed medications. Less than a third of the patients had been using the MDI correctly and a significantly larger proportion of patients was able to use MDI+spacer combination satisfactorily. Patient education and training with respect to compliance and inhaler technique need strengthening. Future studies aimed at evaluating the combined effect of health literacy, asthma knowledge/beliefs along with different inhaler training methods may help fill the gaps identified in this study.

Disclosure Statement

The authors report no conflict of interest.

Funding Source

None.

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Volume 8 Issue 9 September 2019

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