Assessment of inhalational technique of Metered dose inhalers (pMDIs) among its users

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KAS UN conceived idea, KAS AT FN drafted the study, UN FN collected data, AT FN did statistics analysis and interpretation, KAS FN critical review manuscript, All approved final version to be published

Declaration of conflicting interests

The authors declare that there is no conflict of interest.

Abstract

Background: Worldwide prevalence of Asthma and Chronic Obstructive Pulmonary Disease (COPD) is on the rise. Asthma is the chronic inflammatory condition associated with airway hyper-responsiveness leading to airflow obstruction that is reversible.

Objective: Objective of the present study was to assess the inhalational technique of metered dose inhalers among the Asthma and COPD patients visiting a tertiary care hospital.

Methodology: This cross sectional descriptive study was conducted at Combined Military Hospital, Lahore from January 2018 to April 2018. A total of 150 Patients of Asthma and COPD, using the inhaler (pMDI) regularly, were selected by non-probability purposive sampling from medical wards and the outdoor department over a period of 4 months. Children and debilitated elderly patients were excluded. Data was collected by the interviewer on a questionnaire with a checklist of 8 essential steps of correct inhalation technique and other related factors. SPSS version 20 was used to analyze data.

Results: Out of 150 patients selected for the study, 86 (57.3%) were asthmatics and 64 (42.7%) suffered from COPD. 36 (41.9%) of Asthmatics and 15 (23.4%) of COPD scored 6 or more points on assessment. 19 (12.67%) of users also owned a large volume spacer (LVS) and only 6(4%) used LVS regularly. Patients previously educated about correct use and those with prolonged duration of illness (>5 years) showed better technique more often (42% and >50% respectively).

Conclusion: Majority of patients exhibited poor inhalation technique of Metered-dose Inhalers which is the key to controlling asthma and COPD symptoms. Patient training regarding proper technique correlates significantly with better technique Hence, proper patient education on follow up visits and hospital discharge is needed for improved outcome.

Key Words: Asthma; COPD; Assessment; Inhalational technique; metered dose inhalers; pMDIs

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Introduction

Worldwide prevalence of Asthma and Chronic Obstructive Pulmonary Disease (COPD) is on the rise. Asthma is the chronic inflammatory condition associated with airway hyper-responsiveness leading to airflow obstruction that is reversible.[1] Global Asthma Report 2018 states that according to the Global Burden of Disease (GBD) study conducted in 2016, an estimated 339.4 million people worldwide were affected by asthma with greatest burden in children at 10-14 year and elderly 75-79 yrs, and hence, it stands as 16th most important disorder in the world in terms of its extent and duration of disability.[2] COPD, a common preventable and treatable disease, is characterized by persistent airflow limitation that is usually progressive and is associated with an enhanced chronic inflammatory response in the airways and the lungs to noxious particles or gases.[3] WHO and the Global Burden of Disease Study estimates show a prevalence of 251 million cases of COPD in 2016. COPD contributed to 3.17 million deaths in 2015 that make 5% of deaths

globally that year, mostly (about 90%) from low-and middle-income countries.[4] By 2030, COPD will be the 3rd leading cause of death worldwide.[5,6]

These chronic lung diseases are not curable, but are treatable and controllable and one of the crucial roles in its long term control is the treatment with broncho-dilators, corticosteroids and immunomodulators. The inhalation therapy is superior to systemic therapy in the light of fewer side effects and optimal drug response in lesser doses. For that purpose, it is crucial for the patient to know the correct inhalation technique for proper drug delivery to airway and lungs.[7] Unfortunately, several studies in the developed countries indicate that quite a lot of patients using MDIs show poor inhalation technique despite giving a briefing on first clinic visit when prescribed with inhalers.[8-12] Poor inhalation technique results in poor Asthma control, increased COPD exacerbations and poor quality of life.[13]

In our region, many studies have been conducted on this matter and they statistically prove that there was an inverse relationship between education level and incorrect inhaler technique ($p<0.05$)[14] but the research done in this field is insufficient and data is scanty. Considering large prevalence of Asthma and COPD in our society and lack of adequate health education and facilities, much work is required to be done in order to provide better healthcare facilities and improve quality of life of these patients. For that we need to assess the knowledge of correct inhalational technique of pMDIs and also know whether patients are being properly educated by healthcare providers.

Methodology

This cross sectional descriptive study was conducted at Combined Military Hospital (CMH), Lahore from January 2018 to April 2018 for a total duration of 4 months after due approval from hospital ethical committe. Patients of Asthma and Chronic Obstructive Pulmonary disease (COPD) were randomly selected from medical wards, pulmonology OPD and lung Function Lab of Combined Military Hospital, Lahore for the assessment of correct inhalational technique of pMDI. Non-probability purposive sampling technique was used. Both male and female patients were included in the study. Only the patients using pressurised metered Dose Inhalers pMDI and not any other instrument like dry powder inhalers were included in the study. In some cases where attendants would help using the pMDI, the attendant was asked the relevant questions regarding correct inhaler technique. The study is regarding assessment of inhalational technique among adults, so children less than 13 years of age were excluded from the study. Severely debilitated and very elderly patients, who could not provide correct data (less those who had the help of attendants) were also excluded. Data was collected using a questionnaire filled in by the interviewer himself at the time of interview who assessed the inhaler technique using a checklist of 8 steps necessary for appropriate pMDI use which are as follows:[17]

1. Shaking the inhaler
2. Locking the lips appropriately around the mouth
3. Exhale fully prior to pressing the canister

Table 1. Asthma and COPD patients across all age groups

Asthma Patients				COPD Patients			
Age groups	Total Patients	LVS owners	Regular LVS users	Age groups	Total patients	LVS owners	Regular LVS users
13-20	3	1 (33.33%)	1 (100%)	31-40	1	-	-
21-30	6	2 (33.33%)	1 (50%)	41-50	3	-	-
31-40	15	3 (20%)	2 (66.67%)	51-60	16	2 (14.28%)	-
41-50	15	1 (6.67%)	1 (100%)	61-70	28	-	-
51-60	20	4 (20%)	-	71-80	15	2 (16.67%)	-
61-70	22	3 (13.64%)	-	81-90	1	-	-
71-80	5	1 (20%)	1 (100%)	-	-	-	-
TOTAL	**86**	**15 (17.44%)**	**6 (7%)**	**TOTAL**	**64**	**4 (6.3%)**	**-**

*COPD = Chronic Obstructive Pulmonary Disease, LVS = Large Volume Spacer

4. Holding the pMDI between index and thumb and pressing the canister

5. Inhaling via mouth (not nose) as soon as the canister is pressed

6. Taking a deep breath slowly and deeply in

7. Holding the inhaled air for 5-10 seconds after

8. Re-shaking the inhaler for second puff

Patients were asked to demonstrate the technique which he/she employs and their technique was assessed using the parameters given in the checklist. Those who used a large volume spacer(LVS) were asked to demonstrate the technique with LVS. A score out of 8 was given to each patient who was interviewed. Questions regarding age, gender, disease for which pMDI is being used, duration of usage, any previous education on inhaler technique and relief from usage were also asked. Patients were also inquired about knowledge and frequency of usage of large volume spacer LVS (if any). The purpose of the survey questionnaire was explained and Informed verbal consent was taken from each patient before data collection. Data were processed and analysed using SPSS version 20.0. Statistical significance was set at P<0.05.

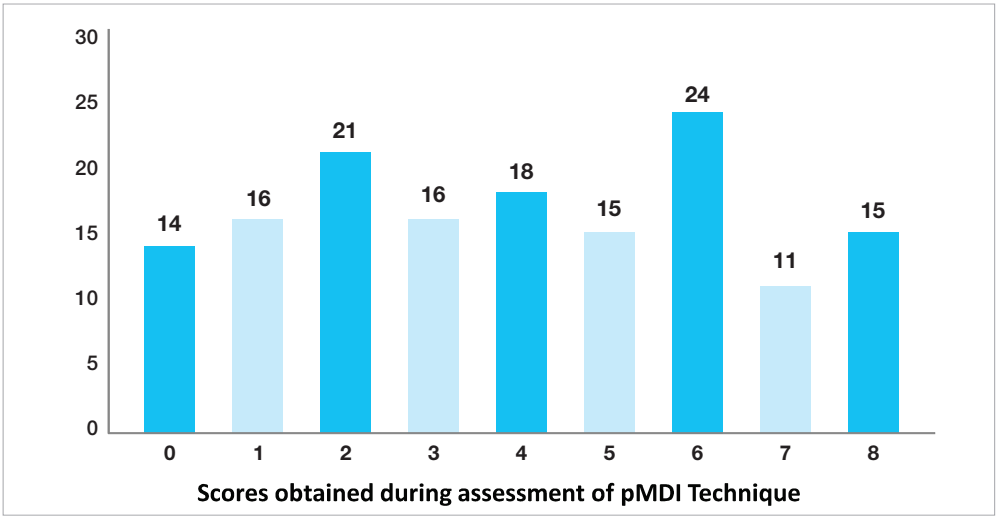

Figure 1. Bar Chart showing total no. of patients against each score across all age groups

Results

A total of 150 questionnaires were analyzed by using SPSS 20.0. The age ranged from 18 to 82 years with Mean Age of 57.75(SD 14.6) years. Mean Age of Asthmatics was 51.7 years while that of COPD patients was 66.15 years. Out of these, 122 were

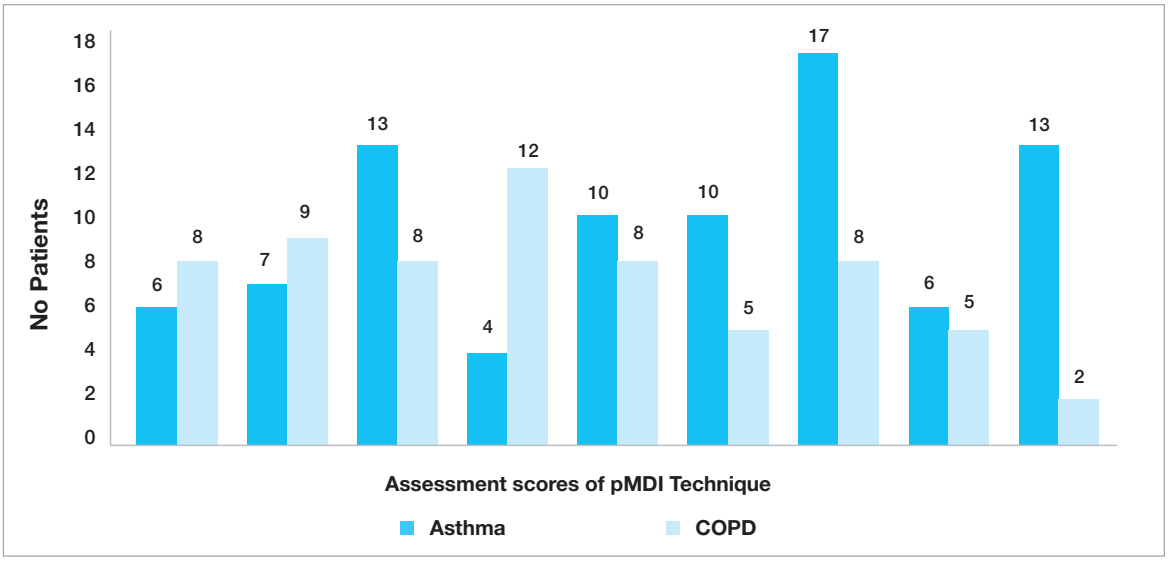

Figure 2. Bart Chart showing total no. of Asthma and COPD Patients against each score across all age groups

males and 28 were females, with sex ratio of 4.4:1. 86 (57.3%) subjects were diagnosed with Asthma while 64 (42.7%) suffered from COPD. 48 of the subjects were admitted in Medical ward, out of which 26 (54.17%) had Asthma and 22 had COPD. Rest of 102 (68%) patients were interviewed in OPD, 60 (58.8%) of whom had Asthma and 42 (34.3%) had COPD. Following table (I) shows the total no of patients suffering from Asthma and COPD in each age group alongwith information about LVS(if any) owned and its use.

Out of 150, 19 (12.67%) patients owned a large volume spacer and out of them, only 6(4%) used it regularly.

The bar chart in Figure I shows the total no. of patients against the total scores they attained during the assessment of inhaler technique. The most common score attained overall was 6.

51(34%) of patients scored 2 or less, while 50 (33.33%) scored 6 or more after examining the technique. Furthermore, when the data were analysed based on the scorecard of Asthmatics and COPD patients separately as in Figure II, it revealed that most common score among asthmatics was 6, while that among COPD patients was 3.

Furthermore, 36 (41.9%) of Asthmatics scored 6 or more points on assessment while 15 (23.4%) of COPD scored the same. 26 (30.2%) of Asthmatics and 25 (39.1%) of COPD patients scored 2 or less. This also shows asthmatics scored better technique than COPD patients.

While correlating the individual scores of patients against their duration of illness, the data was compiled and analysed in the form of following Line diagram(Figure III). It depicts that only 13.8% of patients who were using pMDI for less than 1 year scored 6 or more which increased to 50% in those who were using it for a longer duration(10yrs or more). Similarly, the reverse happened when low scorers were evaluated. 48.3% of those diagnosed less than a year ago scored 2 or less, which reduced to only 5.5% in those using pMDI for more than 10 years.

Another correlation was made of scores obtained against whether patients were previously trained for pMDI use or not. A bar chart was devised (Figure IV) which showed 42% of the trained individuals scored 6 or more points while 26% scored 2 or less. On the other hand, 50% of those not trained for inhaler technique scored 2 or fewer points, and only 16% of this group scored 6 or more points

Discussion

Asthma and COPD are one of the most prevalent chronic diseases world over and the invention of pressurised metered dose inhalers have revolutionised therapeutic management of bronchial asthma and chronic obstructive airway disease. These devices enable the direct delivery of medication to the respiratory system, hence reducing the first pass effect while minimising systemic side effects. However, as only 8.8% of the aerosolised dose reaches the small conducting airway and alveoli even with the proper use of the MDIs,[22] it is important that the patient performs the pMDI technique correctly. There is a strong correlation between proper inhaler technique and control of disease progression/symptoms.[7-9]

Incorrect inhaler technique employed by the patients is one of the biggest reasons for poor symptom control and chronicity of both diseases. This has been time and again highlighted in many international studies which show that even in more literate world, improper use of pMDIs is an issue which leads to poor

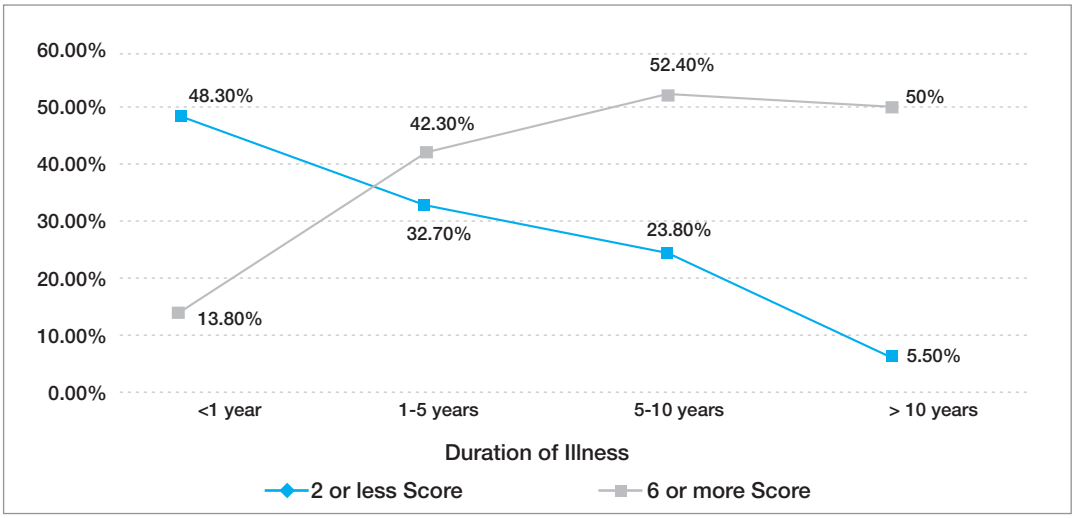

Figure 3. Frequency Polygon correlation of scores with duration of illness of patients

symptom control.[10-12] Most studies find that the major reason for such a widespread lack of using correct inhalation technique is, apart from illetracy,[11,16] lack of proper patient education on part of health care administrators.[13,17,20,21] Before and after training results in some studies show statistically significant improvement in inhaler technique.[11,20]

The main aim of this study was to get a local picture since not many studies are available regarding local situation. Those that are available[14,15,18,19] highlight the lack of knowledge of correct inhaler technique and inadequate patient education leading to poor symptom control and compromising the quality of life of these patients. The need to collect more data on the local situation is all too evident, as is the importance of better patient education, which can prevent morbidity and mortality in these patients, improve their quality of life and, just as importantly, aid cost-reduction and effectively reduce the burden on the local health-care system.

Studies, both local and international, also indicate lack of proper technique among healthcare providers [13-15,21] and therefore are not in a position to coach patients effectively. One of the reasons maybe insufficient knowledge about inhaler technique in medical textbooks. In a study only two out of forty books included a simple list of steps about proper technique of pMDI.[21] Hence studies recommend complete description on inhaler use in medical textbooks of both doctors and nurses because ultimately It is they who have to train their patients about correct inhaler use. Seminars can also be arranged for prescribing physicians.

The importance of verbal instructions and practical demonstration of correct technique to the patients and caregivers cannot be overstressed. Therefore, it has been suggested that the technique for using the inhaler device should be described to the patients in a face-to-face session by the prescribing physician.[13,14,20] In one of these studies,[20] the rate of correct usage was 58.9% for dry powder inhalers (DPI) and 31.1% for pressurized metered dose inhalers (pMDI) before the training. The parameters affecting correct usage were educational status, gender, living in rural areas, duration of disease, and being diagnosed and followed-up by a chest diseases specialist. The rate of correct usage increased to 92.6% for DPI and 45.2% for pMDI after the training ($p<0.001$). The factors affecting continued incorrect usage after standard training were old age and the type of the pMDI device.

Moreover, caregivers and patients require continuous training sessions. This is because even repeated instructions could be insufficient to achieve improved adherence in the long term, as there is a tendency for patients or caregivers to forget what they have learned as time elapses since the training event.

As far as locally available data is concerned, most studies show that the two major factors that have a significant correlation with poor inhaler technique are illiteracy[14] and lack of application of proper technique; which is either due to lack of knowledge among doctors[15] and/or caregivers/patients.[18,19] In our study too, it has been observed that there is a marked difference of score between those that were taught the technique by some healthcare giver and those who were not, as described in results. The former group significantly obtained better scores in higher percentage(42%) than later(16%). Another observation is a clear improvement in percentage of patients with better scores with increased duration of usage of pMDI. 13.8% of patients who were using pMDI for less than 1 year scored 6 or more which increased to 50%

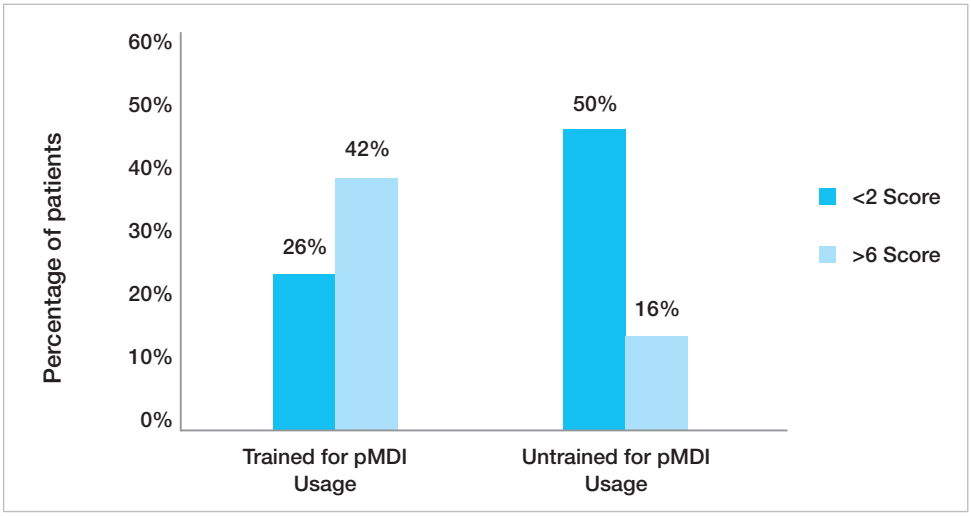

Figure 4. Bar chart showing effect of previous training on inhaler technique

in those who were using it for a longer duration (10yrs or more). This might be the result of more doctor-patient interaction due to repeated visits. Even more striking is the rapid decrease, with more duration of use, in percentage of patients who demonstrated very poor technique (From 48% to 5.5%). However, this is an observation in our study and more data and studies are needed to prove/disprove this as for as local situation is concerned.

The use of LVS leads to marked improvement in drug delivery[11] to the airways; however, its use is very nominal (4%) among our patients while its importance is even more in our society where majority of the patients are illiterate and use of LVS can not only ease pMDI use but also aid proper drug delivery in lungs. Very little data is available regarding knowledge and use of LVS in our setup.

Conclusion

It is a well known fact that appropriate drug delivery via a pMDI is key in controlling the symptoms of asthma and COPD but it is a common observation that patients tend to have poor inhalation technique, as highlighted above in the results and discussion section, leading to poor control of symptoms and poor quality of life. The main reason for this is lack of continuous patient education and illiteracy due to which people tend to use these devices for long duration without significant improvement in symptoms. There is a need for clinicians to monitor inhaler technique more often. It might be a good idea to possibly train specialised nurses, pharmacists and GPs to monitor this technique. Apart from proper technique, people also tend to have poor knowledge about large volume spacers (LVS) which, if used, results in significant improvement in drug delivery into the lungs. This is in contrast to the western studies which show that most people either use or know about spacer devices. Hence the cornerstone is continuous education of patients on follow up visits and hospital discharge to improve the outcome of disease and symptom relief.

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