



Original Article

Evaluation of Inhaler Technique amongst Asthmatic and COPD Patients Attending a Tertiary Care Hospital

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Abstract

Inhalation therapy forms the backbone of the treatment of asthma and COPD patients. In spite of advances in the designing of the various inhalation devices, faulty inhalation technique has been prevalent through years, leading to inadequate delivery of the inhaled medications to the airways which results in poor management of these disorders. This observational and questionnaire based cross sectional study was conducted on COPD and asthma patients to analyse their inhaler technique. A total of 300 patients who were using any of the three inhalational devices viz DPI, MDI or MDI with spacer were enrolled for the study. Patient's demographic data was collected and were asked to demonstrate their technique of using the inhalation device. Each step of the technique was compared with that of the standard checklist. Amongst the enrolled patients, only 20.33% completed all necessary steps of their prescribed inhaler technique, while 79.67% did at least one error while performing the technique. Among various devices, 22.67% (n=34) of patients using DPI; 13.33% (n=12) using MDI; and 25% (n=15) using MDI + Spacer could complete all the necessary steps of usage of their inhalation device. The study revealed that performance technique of inhalation devices amongst majority of the patients was not optimum. Diverse factors including low education status, old age, rural residence, lack of awareness and tobacco smoking habits were found to be associated with poor inhaler technique. Thus patient education, training and rather a practical demonstration regarding proper utilization of the device remain the cornerstone of fruitful management.

Keywords: *Inhalation therapy, technique, device, COPD, asthma.*

Introduction

Asthma and Chronic Obstructive Pulmonary Disease (COPD) are respiratory diseases with high prevalence rate all over the world, being major causes of morbidity and mortality. According to the global burden of disease studies in 2015,

COPD and asthma ranked among the top 20 conditions causing disability globally and were ranked 8th and 23rd respectively^[1,2]. COPD is the fourth leading cause of death in the world currently and is projected to be the third by 2020.^[3] Asthma affects 339 million people all

over the world, leading to death of around 1000 people every day.^[4]

Inhalation therapy remains the mainstay for treatment of COPD and asthma, in which medications are administered directly to the airways, providing a higher local concentration and a lower risk of systemic side effects.^[5] The dry powder inhaler (DPI), metered dose inhaler (MDI), and MDI with spacer are the preferred pulmonary drug delivery methods used globally, as patients are able to use them on their own or with minimal assistance.^[6]

Whereas Newton patented an inhaling apparatus for the delivery of dry powder medications in 1864 in London, pressurised metered dose inhaler was developed in 1956.^[7,8] Although inhalation therapy devices has evolved in their design over past few decades, there has not been much improvement in the way patients use them. A proper use of these devices in administering the drugs invariably has a direct relationship with the delivery and efficacy of the medications. When the technique of inhalation is poor, the drugs are often not delivered appropriately to the site of action which leads to poor treatment outcome.

In a study conducted by Souza et al^[9] (2009) on 120 subjects (60 asthma, 60 COPD), 113 patients (94.2%) committed at least one error when using the inhalation device, while Maricoto et al^[10] (2015) found that amongst sixty two patients, 74.19% made at least one error while performing inhaler technique. In another study by Pothirat et al^[11] (2015) in a total of 103 COPD patients, 75% performed at least one step incorrectly. Therefore, these studies have unanimously stated that incorrect inhaler technique is highly prevalent among asthmatic and COPD patients, warranting urgent clinical attention to implement measures to improve the patients' inhalation technique for better treatment outcome. Flaws in inhalation technique leading to poor treatment outcome can prompt the patient to default the inhalation therapy and rely on alternative medicines for treatment. Upon realising the fact that prevalence and type of errors in inhaler technique can vary

from population to population depending on the demographic profile including literacy status of people, current study was planned to explore it further, in this region.

Materials and Methods

It was an observational and questionnaire based cross sectional study conducted in diagnosed cases of COPD and asthma, attending the out-patient section of Department of Pulmonary Medicine, Government Medical College, Patiala, Punjab, India. A total of 300 patients, who were using any of the three inhalational devices viz DPI, MDI or MDI with spacer and who met the inclusion criteria were enrolled for the study. The study was approved by the ethical committee of the institution. Data were collected including patient's name, age, sex, residence (rural or urban), literacy status, smoking habits etc. The subjects were asked to demonstrate their inhalation technique with their own inhaler. Each step of the technique was compared with that of the standard checklist (as infra) of that particular device and correctness of the step was documented as 'yes' or 'no'. Afterwards, the correct technique was explained to the patient by practical demonstration with placebo device and assured proper understanding of each step by the patient. Further, the technique performance was reassessed. All interviews were carried out by a single trained investigator and data obtained were entered in Microsoft excel worksheet and analysed systematically.

Checklist of DPI usage technique^[5,12,13]

- 1) Remove the cap
- 2) Load dose (device specific)
- 3) Pierce the capsule
- 4) Breath out
- 5) Place mouthpiece between teeth without biting it and close lips to form a good seal
- 6) Breath in strongly and deeply
- 7) Hold breath for 10 seconds
- 8) Breath out gently away from mouthpiece
- 9) Replace the cap
- 10) Rinse the mouth with water or mouthwash (only for steroid containing inhalers)

Checklist of MDI usage technique^[5,12,13]

- 1) Remove the cap
- 2) Shake the inhaler
- 3) Hold the inhaler upright
- 4) Breath out gently
- 5) Place mouthpiece between teeth without biting it and close lips to form a good seal
- 6) Press down the canister once while breathing in slowly and deeply and continue breathing after firing the device.
- 7) Hold the breath at least for 10 seconds.
- 8) Breath out gently away from the mouth piece.
- 9) Replace the cap.
- 10) Rinse the mouth with water or mouthwash (only for steroid containing inhalers)

Checklist of MDI with Spacer usage technique^[5,12,13]

- 1) Assemble the spacer
- 2) Remove the cap of inhaler
- 3) Hold the inhaler upright and shake well
- 4) Insert the inhaler upright into spacer
- 5) Breath out gently
- 6) Place mouthpiece between teeth without biting it and close lips to form a good seal
- 7) Press down the canister once and breathing in slowly and deeply
- 8) Hold breath for at least 10 seconds
- 9) Breath out gently
- 10) Replace the cap and disassemble the spacer
- 11) Rinse the mouth with water or mouthwash (only for steroid containing inhalers)

The inclusion criteria were subjects of COPD or asthma, age group of 18-60 years who extended willingness to take part in the study and given informed written consent. Whereas exclusion criteria included those who were newly started on inhalation devices (less than 4 weeks of study visit), with severe respiratory symptoms requiring hospital admission at the time of study visit, who were physically challenged or suffering from any neurological/psychiatric illness, that may interfere with use of inhalation device and who were unwilling to take part in the study.

Results**Demographic Profile**

Out of 300 patients enrolled, 189 (63%) were males and 111 (37%) females. The average age was 43.57 ± 12.65 years (Fig.1). Mean age of asthmatics was lower (34.28 years) than that of COPD patients (51.81 years) (Fig.2).

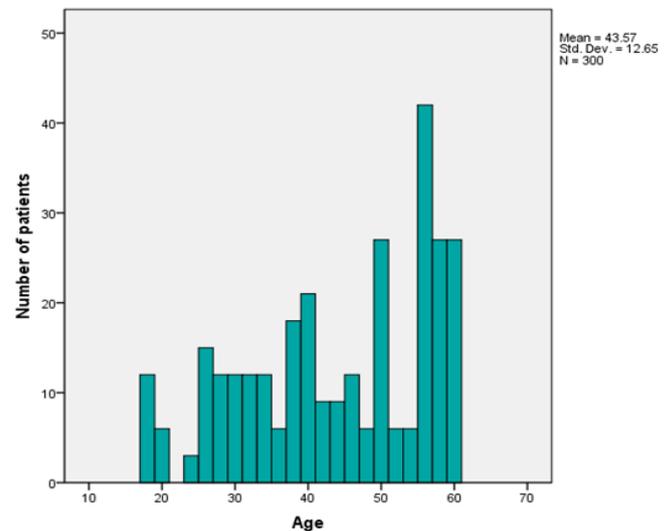


Fig 1: Age Distribution of the Patients in the Present Study

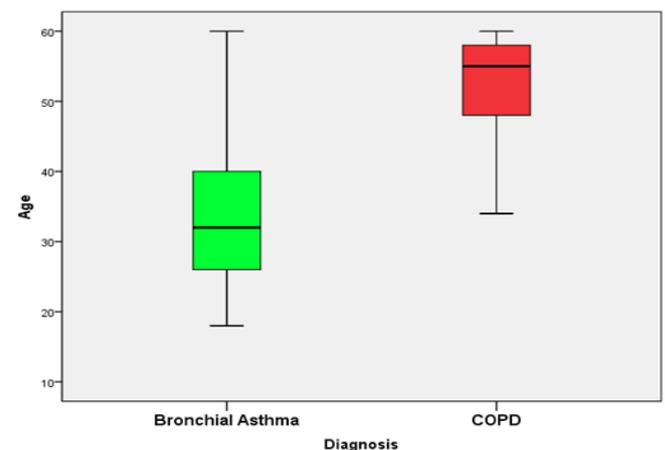


Fig 2: Age distribution of patients based on diagnosis

Out of 300 patients, 96 (32%) were residing in urban area and 204 (68%) in rural area. Majority of patients were having below secondary level education status (n=129, 43%). Illiterate patients accounted for 26.67%. Majority of the patients were house wives (n=81, 27%), followed by farmers (n=54, 18%) and manual labourers (n=48, 16%). Amongst n=300, fifty one patients (17%) were smokers, 84 (28%) were ex-smokers whereas 165 (55%) were non-smokers.

About 141 (47%) were having a diagnosis of asthma while 159 (53%) were having a diagnosis of COPD. Dry Powder Inhaler was the most common device used among both asthmatic and COPD groups (n=72 & 78 respectively).

Errors in Inhalation Device usage

Among 300 patients enrolled in the study, only 20.33% completed all necessary steps of their inhaler technique whereas 79.67% did at least one error while performing the technique. Among various devices, only 22.67% (n=34) of patients using DPI, 13.33% (n=12) using MDI, and 25% (n=15) using MDI + Spacer could complete all necessary steps of usage of their inhalation device (Fig.3).

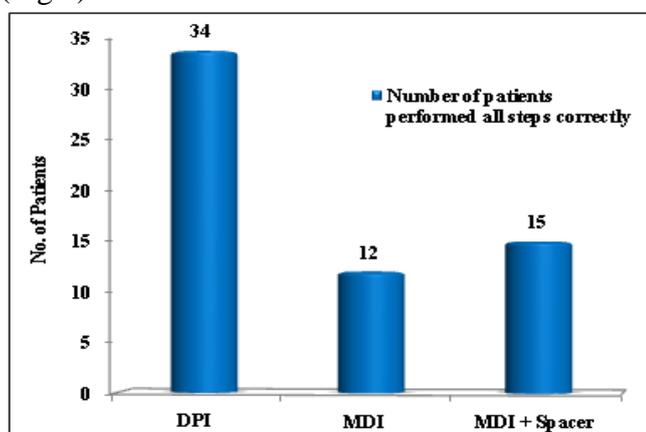


Fig 3: Distribution of number of patients performed all steps correctly

Among DPI users most common mistake was in step 4 (Breathing out before inserting mouth piece into mouth) followed by step 7 (Hold the breath for at least 10 seconds). Among MDI group, error was step 2 (Shake the inhaler) followed by step 7 (Hold the breath for at least 10 seconds). Among MDI + Spacer group maximum performing mistake being step 8 (Hold the breath for at least 10 seconds) followed by step 3 (Hold the inhaler upright and shake well) and step 11 (Rinse the mouth with water) (Table-1)

Percentage of inadequate inhaler technique was higher among COPD group (n=144, 90.6%) compared to asthmatic group (n=95, 67.4%) (Fig.4).

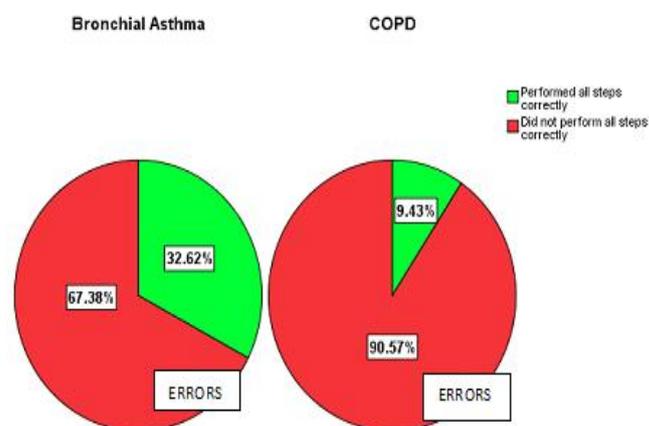


Fig 4: Distribution of correctly and wrongly done steps among asthmatic and COPD patients

Table-1 Frequency of Errors in Performance of all Steps among Different type of Inhalation Devices in the Study

Steps	DPI		MDI		MDI + Spacer	
	Number of errors	Percent of errors	Number of errors	Percent of errors	Number of errors	Percent of errors
Step 1	0	0	0	0	18	30
Step 2	6	4	60	66.7	0	0
Step 3	3	2.0	15	16.7	30	50
Step 4	104	69.3	48	53.3	0	0
Step 5	3	2.0	3	3.3	27	45
Step 6	36	24	45	50	0	0
Step 7	84	56	57	63.3	3	5
Step 8	27	18	24	26.7	36	60
Step 9	6	4.0	3	3.3	12	20
Step 10	48	32	36	40	9	15
Step 11	NA	NA	NA	NA	30	50

Discussion

DPI and MDI with or without spacer are amongst the different types of dispensing devices for lung

deposition of drugs, most commonly used worldwide because of the convenience of their use independently by the patient or with minimal

assistance, for treatment of asthma and COPD. Poor inhalation technique leads to insufficient medication-effects, prescription of more or additional medication with a higher probability of side effects, disease escalation and increased costs.^[14] With sparse data available on this subject matter related to this region of the country, the present study was designed and conducted to carry out the inhaler technique evaluation.

Out of 300 patients enrolled in the study, only 20.33% patients completed all necessary steps of their inhaler technique while 79.67% did at least one error. Among various devices, only 22.67% (n=34) of patients using DPI, 13.33% (n=12) using MDI, and 25% (n=15) using MDI + Spacer could complete all necessary steps of usage of their inhalation device.

In a study by van Beerendonk et al^[15] (1998), 88.9% made at least one mistake in their inhalation technique. In a study conducted by Hammerlein et al^[16](2011),78.9% of patients made at least one mistake in performing the inhalation technique. In a study conducted by Ganguly et al^[6] (2014), among DPI users only 16.12%, among MDI users only 6%, and among MDI with spacer users only 20.8% could use inhalers correctly. The results of the present study are well consistent with the earlier studies on the subject, showing vast majority of the patients using wrong inhalation technique on these devices.

In the present study, most common mistake among DPI users was in step 4 (Breathing out before inserting mouth piece into mouth, 69.3%) followed by step 7 (Hold the breath for at least 10 seconds, 56%). In a study by Alamoudi^[17] (2003) in the DPI group; failure to holding breath was most common mistake (23.1%) whereas in a study by Ocakli et al^[18] (2018), failure to breath out before inhaling through device was the most common error amongst all devices in both COPD and asthma groups.

In the current study, most common error among MDI group was step 2 (Shake the inhaler) followed by step 7 (Hold the breath for at least 10

seconds) and step 4 (breathing out before inhaling). Non-synchronization between the act of actuation of the device and deep inhalation (step 6) was still another important error seen. In a study by Sodhi et al^[19] (2017), most common error for MDI was not holding breath for 10 seconds which was seen in 46 patients (51.7%), while in a study by Ammari et al^[20] (2015), step 2 (shake the inhaler) and step 6 (Inhale slowly while actuating the device and continuing inhalation) were most common errors in MDI use. In the current study, among MDI + Spacer group maximum error was at step 8 (hold the breath for at least 10 seconds) followed by step 3 (hold the inhaler upright and shake well) and step 11 (rinse the mouth with water). Although the type of errors varied among different devices, the step of breath holding was found to be a wrongly done step in amongst all devices in this study.

The present study unequivocally revealed high prevalence of errors as detected in the performance of inhalation techniques, like the previous mentioned studies. It therefore remains an area of concern while treating these patients and expecting the desired results of medication. Breathing out fully (or as much as is comfortable) reduce the amount of air in the airways, thus increasing the available for the air from next breath; resulting into a deeper inhalation, maximizing the opportunity to carry the drug to the site of action. Higher percentage of errors in this step may be due to the lack of awareness regarding importance of full exhalation, amongst patients. Non-performance of the step of shaking the MDI-canister will lead to inconsistent drug dosing. Inadequate breath holding decreases the probability of the drug particle deposition in the lungs through the process of sedimentation. Breath-holding step remains important, because otherwise immediate exhalation after an inhalation could result in higher amount of drugs being pushed out of airways before the drug particles could sediment down with gravity. Performing the step of rinsing the mouth with water after using ICS will help in washing out of the residual drug

from the oral cavity, in turn reducing the incidence of oral thrush which is often found in association with inhaled corticosteroid use.

The percentage of patients with inadequate inhaler technique was higher among COPD group (n=144, 90.6%) than asthmatics (n=95, 67.4%) in the present study, as was observed by Melani et al^[21] (2011) in their study showing asthmatic patients had better inhaler technique performance than COPD patients (OR 1.01±0.12; p=0.002). Also, this study revealed that mean age of asthmatics were lower compared to COPD patients. The finding conforms to the fact that COPD is a relatively old age disease and cognition issues, dependence on caregivers, other geriatric conditions, poor respiratory efforts etc may likely be the associated reasons for higher number of errors among elder patients.

Majority of the patients enrolled in the present study were residing in the rural area and had a low education status. India being a nation, accounted with rural population dominance is likely to be the reason for majority of patients being from villages. Illiterate patients' number was also high in the study population, probably another factor for incorrect technique; as was detected by Pothirat et al^[11] (2015) that low education level was the single most important factor related to incorrect technique. The number of smokers found were less (17%) in our study population and this trend can be attributed to the prevalent religious practices in this region of the nation, which discourage tobacco smoking.

Conclusion

The study explores and highlights that majority of patients do not use their inhalation device in optimum manner which remains an area of concern for the treating clinicians and health care workers. Due consideration should be given to the diverse factors including low education status, old age, rural residence, lack of awareness and tobacco smoking habits while advising for a particular inhalation device. Apart from prescribing the device, physician should spend

time on patient education, counselling and training. Unequivocally, spending some time on practical demonstration of the technique ensuring proper utilization of the device will play a pivotal role and translate into fruitful management of the disorders. This study should provide an impetus for further studies on the subject so as to tackle the burden of the disorders and their exacerbations.

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Conflict of interest: None

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