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Assessment of the Various Inhaler Techniques in Chronic Obstructive Pulmonary Disease: A Cross Sectional Study

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ABSTRACT
Chronic obstructive pulmonary disease (COPD) is a common medical problem. The improper implementation of inhaler techniques that are used in such patients leads to the reduced effect of medicines. This study was conducted to evaluate the correct use of various inhalers among COPD patients. This Cross-sectional study was carried out on 120 patients aged over 40 years with COPD under the treatment of using at least one inhaled medicine for a month or more. The adopted technique of applying application techniques of five types of inhalers including MDI, single dose DPI, Turbuhaler, Diskus and Handi Haler, were evaluated according to a standard checklist. Patient's demographic variables and inhaler performance scores of all procedures were recorded and the collected data were analyzed in SPSS software (version 22). The participants were elderly, mean age 62.7+10.9 years, predominantly male (60%). Most of them using MDI spray (66.7%) followed by single dose DPI (31.6%), Diskus (16.6%), HandiHaler (10%) and Turbuhaler (8.3%) respectively. Majority of the patients (70%) used one form inhaler. The most common mistakes in using all inhalers were related to the Not breathing out before inhalation and holding the breath steps after using the inhaler, respectively. The identification of associated with the misuse of inhaler could provide information to implement appropriate actions to reduce the technical errors of inhaler use. Physicians must evaluate and modify the use of inhalers in every COPD patient

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a widespread condition globally, affecting an estimated 7% of the global population[1]. It is a chronic illness characterised by airflow limitation that can be managed with inhaled corticosteroids. According to the World Health Organisation, COPD is currently the fourth largest cause of death as well as the most widespread. It is expected to be the third biggest cause of mortality globally by 2030[2]. Proper use of inhaler devices is essential for managing chronic obstructive pulmonary disease (COPD) and requires ongoing training[3]. Device selection should consider availability, pricing, patient and physician preferences and clinical situation[4]. No definitive treatment for COPD has been established and present medicinal medications can only alleviate symptoms and lessen the frequency and intensity of attacks[5]. Patients have access to a variety of inhalers, including metered-dose inhalers (MDI) and nebulisers, breath-actuated MDIs and five types of dry powder inhalers (DPI), including Turbuhaler, Diskus, and HandiHaler, of which MDIs are commonly prescribed[6]. Efficient administration of inhaled drugs to the airways via pressurised metered-dose (pMDI), dry-powder and soft-mist inhalers is critical for the best treatment of obstructive airway illnesses (asthma and chronic obstructive pulmonary disease (COPD) in both adults and children. Correct inhaler technique is vital to achieving optimal results, however studies show that up to 90% of patients make critical inhaler technique errors[4,7], a situation that has not changed in the last four decades. Critical inhaler technique errors have a direct impact on drug delivery effectiveness, which can lead to poor disease control[8].

Aims and Objectives: This study was performed to determine the use of various inhalers techniques among chronic obstructive pulmonary disease to identify the most important technical problems experienced by patients as well as the inhalers.

MATERIALS AND METHODS

This observational cross-sectional study was conducted in the department of pulmonary medicine in tertiary-care teaching hospital, India. The population of this research consisted of 120 patients with COPD selected by random sampling method. COPD patients were diagnosed in accordance with the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria[3].

Inclusion Criteria:

- Patients aged over 40 years, both gender.
- Patients diagnosed with COPD confirmed by spirometry.
- Patients who received treatment with one or more inhalation medicines for at least 3 month.
- Patients who provide written informed consent for the study.

Exclusion Criteria:

- Patients <40 years of age.
- Patients were trained by general practitioners, specialists, or any health care workers.
- Patients with severe tremor, Alzheimer's, dementia, severe forgetfulness, confusion, acute psychiatric problems, severe visual and hearing impairments affecting inhaler techniques.
- Patients who not provide written informed consent for the study.

In this research, the application techniques of five types of inhalers including MDI, single dose DPI, Turbuhaler, Diskus and HandiHaler, were evaluated according to a standard checklist. The researchers, initially, collected the demographic characteristics of the participants, including age and gender, medical records, comorbidities, number of hospitalizations and referrals within the past year and the type, duration, and frequency of medication. The general score of patients in the adopted technique of using the inhaler was recorded and in case that the subjects showed errors in one of the basic stages of this process, they were divided into two groups of correct and incorrect users., No feedback was given during the procedure.

Statistical Analysis: Statistical analyses were performed using the Statistical Packages for Social Sciences Version 25.0. Continuous data are expressed as mean±standard deviation (SD) and descriptive data are expressed as percentages. All statistical assessments were 2-tailed and the level of significance was set at $p<0.05$.

RESULTS AND DISCUSSIONS

Over the study period, 120 patients diagnosed as COPD were enrolled and analysed in the present study. The participants were elderly, mean age 62.7±10.9 years, predominantly male (60%). Most of them (57.5%) resided in rural area, 41.6% had illiterate and majority of them (43.3%) belong to lower socio-economic class. Common comorbidities associated with the COPD were diabetes (45.8%), cardiovascular disease (30.8%) and renal disease (10%). Details of demographic features were shown in (table 1). All patients had been trained to use the inhaler at least once before referring to the clinic. In our study, 70% of the patients used one form

Table 1.Demographic Characteristics of Study Patients

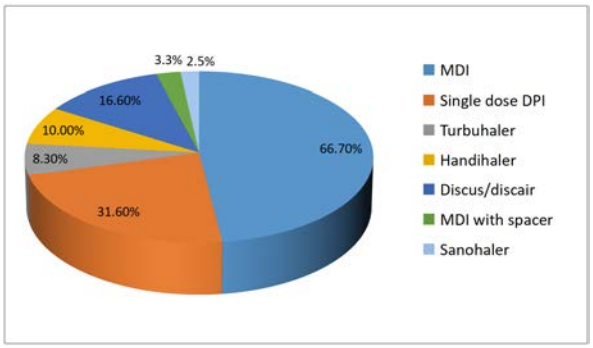
Demographic variables		Frequency (%)
Age (years) Mean±SD	2.7±10.9	
Gender	Male	72 (60%)
	Female	48 (40%)
Living place	Urban	51 (42.5%)
	Rural	69 (57.5%)
Literacy	Illiterate	50 (41.6%)
	Literate	70 (58.4%)
Occupation	Employed	84 (70%)
	Unemployed	36 (30%)
Socio-economic class	Lower	52 (43.3%)
	Middle	39 (32.5%)
	Upper	29 (24.2%)
Comorbidities	Cardiovascular	37 (30.8%)
	Diabetes	55 (45.8%)
	Renal	12 (10%)
	Others	16 (13.4%)

and the other 30% used >one form of an inhaler. The mean duration of inhaler use was 67.8+55.2 months, the mean number of training of correct inhaler use technique was 3.7+1.9 and mean hospitalisation time during last year was 1.7+1.2 days.

Table 2: Characteristics of Patient's Clinical Care

Patients characteristics		Frequency (%)
Number of inhalers used by each patient	One	84 (70%)
	Two	32 (26.6%)
	>Two	4 (3.3%)
Duration of using the inhaler (months)	Minimum	1
	Maximum	300
	Mean±SD	67.8+55.2
Number of training of correct inhaler use technique	Minimum	1
	Maximum	10
	Mean±SD	3.7+1.9
Number of hospitalizations during the last year	Minimum	0
	Maximum	10
	Mean±SD	1.7+1.2

Based on the result, 66.7%, 31.6%, 8.3%, 10%, 16.6%, 3.3% and 2.5% of patients used MDI spray, single dose DPI, Turbuhaler, HandiHaler, Diskus, MDI with spacer and Sanohaler respectively



Graph 1: Types of Inhalers Used Among Study Subjects

According to the findings, the steps of Not breathing out before inhalation and Not breath holding after inhalation were found to be the most common technical errors in using MDI, single dose DPI, Turbuhaler and Handihaler inhaler using patients whereas Not breath holding after inhalation was common technical error among patients using Diskus inhaler.

Table 3: The Most Common Mistakes According to Different Types of Inhaler

Device	Type of critical errors	N (%)
MDI (80)	Not breathing out before inhalation	53 (66.3%)
	Not shaking the device	41(51.3%)
	Not breath holding after inhalation (8-10 sec)	39 (48.7%)
Single Dose DPI (38)	Not breathing out before inhalation	29 (76.3%)
	Not breath holding after inhalation	23 (60.5%)
	Not controlling whether some powder drug rests after inhalation	3 (7.8%)
Turbuhaler (10)	Not breathing out before inhalation	8 (80%)
	Not breath holding after inhalation	7 (70%)
	Not checking the device visually whether there is adequate drug in it	2 (20%)
Handihaler (12)	Not breathing out before inhalation	10 (83.3%)
	Not breath holding after inhalation	7 (58.3%)
Discus/Discair (20)	Not breathing out before inhalation	2 (10%)
	Not breath holding after inhalation	11 (55%)
	Not checking the device visually whether there is adequate drug in it	6 (30%)
MDI with spacer (4)	Shake MDI well	2 (60%)
	Seal lips around mouth piece	3 (75%)

Due to the global prevalence of respiratory diseases, especially COPD, various efforts have been made to improve treatment methods with the help of various types of respiratory inhalers. Since awareness of technical problems is essential to improve community health, the researchers who examined the correct use of inhalers adopted different evaluation systems. In the current study, COPD was more common among elderly's males., similar finding reported by P. Chorao[9] and Beigoli[10]. Regarding the results of previous studies, such individuals would face more problems in caring for the disease and the proper use of inhaled medications. Based on the findings of our study, a higher percentage of patients used MDI spray than other inhalers, which was consistent with the results of other studies performed by Press[11] and Sulaiman[12]. We have found that low education level and lower socio-economic status were associated with the rate of inhaler misuse, but association was not significant, in agreement with the Chaicharn[13] and Liang[14], found no significant correlation between socio-demographic data such as age, gender or education level and incorrect inhalation technique. In the present study majority of the patients use single inhaler techniques and some using dual inhaler, concordance with the Brandon[15]. In the present study, the most common error that occurred in using MDI was the 'holding the breath' stage before and after inhalation, our results comparable with the Al Ammari[16] and Hatefi[17]. Some researchers believe that specialists do not routinely demonstrate the correct technique to patients., therefore, patients cannot learn the steps, leading to a high rate of technical errors in MDI use. For patients

who are required to use MDI, it is reasonable to utilize this device with a spacer to reduce the need for inhalation and actuation coordination[18]. The main advantage of DPI over MDI is that since the aerosol of the drug is guided by the patient's breathing, there is no need to coordinate inhalation and actuation. However, if the patient is unable to breathe in properly, the drug may not be delivered to the lungs successfully[19]. In our study Not breathing out before inhalation and Not breath holding after inhalation were found to be the most common technical errors in using MDI, single dose DPI, Turbuhaler and Handihaler inhaler using patients, our findings correlates with the[20].

CONCLUSION

It is very typical for people with COPD to use inhalers incorrectly. Therefore, it is essential to instruct and assess patients on how to use inhalers correctly in order to fulfill the goal of providing them with appropriate care for COPD. If not, there could be negative effects including the condition not being controlled, the need to use several medications and higher expenses for both the patient and the healthcare system.

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