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Evaluating the technique of use of metered dose inhaler and dry powder inhaler use technique among bronchial asthma and COPD patients attending tertiary health care centre in South India

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ABSTRACT

Background: Inhaler is a device used by patients who have chronic respiratory illness. Inhaled medication is directly deposited in the lungs, which is its site of action. Improper use of inhalers can lead to worsening of disease, over medication and side effects including oral candidiasis. This study aims to evaluate the inhaler use technique.

Methods: A hospital based cross sectional study using pretested semi-structured questionnaire was conducted among 120 participants who were using inhalers for one year or more attending respiratory medicine OPD.

Results: The majority of 81 patients were MDI users. Only 8.64% of them performed all the steps according to NIH guidelines regarding proper technique of inhaler use. Among the 39 patients who used dry powder Inhaler, 33% correctly performed all the steps according to the guidelines.

Conclusions: Only a low proportion of patients properly performed the steps in the technique of using inhalers. Improper use of inhalers leads to poor efficacy of the treatment. So health care providers should take measures to ensure that the patients on inhalers are aware of the proper technique and are following the steps in using inhalers correctly.

Keywords: Bronchial asthma, COPD, Metered dose inhalers, Dry powder inhalers

INTRODUCTION

Bronchial Asthma and Chronic Obstructive Pulmonary Disease (COPD) are two chronic lung diseases that are highly prevalent in the world. More than 300 million people in the world are currently suffering from Bronchial Asthma whereas the disease burden of COPD is more than 210 million in the world.¹

Inhalers as part of aerosol therapy are considered as one of the best choice in the treatment of both these conditions. They are cheaper, convenient to use, portable, and provide quick local action with less systemic side effects. The main types of inhalers commonly used are Metered Dose Inhalers (MDI) and Dry Powder inhalers (DPI). MDI are devices that deliver a specific amount of medication to the lungs, in the form of short blasts of aerosolized medicine. The medicine is in a small canister inside a plastic case and when inhaler is pressed, a measured dose of medicine comes out through the mouth piece. It is usually self-administered by the patient. DPI delivers the medication to the lungs in the form of dry powder. The inhaler is breath activated and medication is released only when you take a deep fast breath through it.²

Both MDI and DPI have their own disadvantages as well. Inhalers require a certain inspiratory flow to actuate the medicine, making them less ideal during disease flare-ups, or during end stages of COPD. It may be difficult for young

children, mentally challenged and the elderly to coordinate the steps in using it.

Some of the common errors made by patients in the method of usage include not shaking the inhaler before use, not breathing out before using inhaler, not breathing in the right way for the type of inhaler, not waiting between puffs and not holding the breath after taking the puff.^{3,4}

As proper use of inhaler is needed to ensure optimal drug delivery to the airways, the technique of inhalation is an important indicator of efficacy of the treatment. This study aims to estimate the proportion of patients who follows the correct method of inhaler use.

METHODS

Study design

The study was hospital based cross sectional study.

Study setting

The study was conducted at Respiratory Medicine Out Patient Department of Dr SMCSI Medical College and Hospital in the district of Trivandrum, in Kerala, India.

Study period

The study was conducted for a period two months from September 2019 to November 2019.

Study subjects

The study included adult patients suffering from Bronchial Asthma, COPD or both and using inhalers for a minimum of one year, who attended the Respiratory Medicine OPD of Dr SMCSI Medical College and Hospital between September 2019 and November 2019.

Inclusion criteria

Patients using inhalers for at least the past one year, and who have the inhalers with them during the time of data collection.

Exclusion criteria

Those who are not willing to give consent to participate and those attending OPD with exacerbation of Bronchial Asthma or COPD and those who do not self administer their medication.

Sample size

The sample size was estimated to be 55, calculated using the formulae $N = Z\alpha^2pq/L^2$ where p, is the proportion of proper and correct usage of inhaler as obtained from a previous similar study.⁵ Total 120 patients were included

in the study. Non probability sampling technique was used and every consecutive patient fulfilling the inclusion criteria were included in the study.

Tools and techniques

It included a semi structured questionnaire having 3 domains: for socio demographic profile, details regarding inhaler use, and checklist based on NIH guidelines for MDI and Netherlands Asthma foundation checklist for DPI usage. ⁶⁻⁸

Data collection method

After obtaining informed consent, data were collected from the patients through interview method, using a semi-structured questionnaire, from Monday to Friday every week during OP timings, for a period of 2 months. As part of observing the technique, the participants were asked to demonstrate how they self-administered the inhalers. No oral instructions, prompts or critiques were provided by the observers prior to or during the demonstration.

Data entry and statistical analysis

Data were coded, entered and analyzed using Statistical Package for Social Science (SPSS) 28, trial version. Univariate analysis were done and results were expressed using descriptive statistics.

RESULTS

The median obtained for the age distribution of 120 study participants was 49 (years), with a calculated Interquartile Range of 39. (Q1=23.25, Q2=62). The study participants had a minimum age of 19 years and maximum of 88 years.

Table 1: Distribution of the study population based on the socioeconomic profile (N= 120).

Details of study participants		Number (Percentage)	
Gender	Males	50 (42)	
	Females	70 (58)	
Education	Illiterate	3 (2.5)	
	School certificate	49(40.8)	
	Intermediate / Diploma	36 (30)	
	Graduate	32 (26.7)	
Occupation	Student	33 (27.5)	
	Unemployed	38 (31.66)	
	Employed	49 (40.83)	
Colour of ration card	Yellow	6 (5)	
	Pink	27 (22.5)	
	Blue	34 (28.3)	
	White	53 (44.2)	

Other socioeconomic details of the study participants were analyzed using descriptive statistics (Table1).

Table 2: Distribution of the study population based on the details related to inhaler use (N=120).

Details related to inhaler use			Frequency (N)	Percentage (%)
Type of inhaler	Metered Dose Inhaler	Metered Dose Inhaler		67.5%
	Dry Powder Inhaler	Dry Powder Inhaler		32.5%
Pattern of inhaler use		1 puff	14	17.28%
	Number of Puffs by	2 puffs	23	28.39%
	MDI users (N=81)	3 puffs	3	3.71%
		4 puffs	41	50.62%
	Number of capsules by	1 capsule	19	48.72%
	DPI users (N=39)	2 capsules	20	51.28
Inhalation medication	Bronchodilators	Bronchodilators		22.5%
	Corticosteroids	Corticosteroids		12.5%
	Both		74	61.67%
	Others	Others		3.33%
Practice of inhaler use	Covering of inhaler after	Covering of inhaler after use		91.67%
	Washing mouth after use	Washing mouth after use		76.67%
	Sharing of inhaler with o	Sharing of inhaler with others		0.83%
	Carrying inhaler everyw	Carrying inhaler everywhere		60%
	Missed dose/stopped using	Missed dose/stopped using		24.17%

It was found that more than half, 68% of the participant suffered from Bronchial Asthma compared to COPD (29%). Out of the remaining, 2.56% had complaints of allergy and 0.44% had both COPD and BA.

Table 3: Distribution of study participants who are using MDI based on steps followed according to NIH guidelines regarding proper technique of inhaler use.

Steps	Frequency (%)	
Беерз	Yes	No
Removing cap and holding it in	69	12
proper position	(85.2)	(14.8)
Shake well and expel one puff if	50	31
not used for more than 7 days	(61.7)	(38.3)
Stand/ Sit straight. Breath out	74	7 (8.6)
through mouth.	(91.9)	7 (8.0)
Place mouth piece between	63	18
teeth and close lips without	(77.8)	
leaving any gap	(77.0)	(22.2)
Release one dose while	68	13 (16)
simultaneously breathing in	(84)	13 (10)
Remove inhaler and close	62	19
mouth immediately	(76.5)	(23.5)
Hold breath for 10 seconds or	39	42
for as long as possible	(48.1)	(51.9)
Wait for at least one minute	44	37
before taking the next dose	(54.3)	(45.7)

In the study population minimum duration since diagnosis of the disease was one year and maximum duration since the diagnosis was fifty years with the mean being 11.90 (SD±9.90). The mean duration since the initiation of any

kind of treatment among the study population was 11.646 ± 9.998 years.

Table 4: Distribution of sample population those who are using DPI based on score obtained from Netherlands Asthma foundation checklist regarding proper technique of inhaler use.

Stone	Frequency (%)	
Steps	Yes	No
Hold the DPI vertically and		
position the two halves of the	34	5
DPI such that the fin is not	(87.18)	(12.82)
directly below the capsule hole		
Remove the capsule from its		
bottle and insert it into the hole	34	5
with its transparent end facing	(87.18)	(12.82)
downwards		
Hold the mouth piece firmly	35	4
with one hand and rotate the		•
base	(89.74)	(10.26)
Breath out fully and place the	26	13
mouth piece between your teeth	(66.67)	(33.33)
Close your lips tightly around it		
& tilt your head slightly	37	2
backwards and breath in	0,	_
through the mouth rapidly and	(94.87)	(5.13)
deeply		
Hold your breath for 10 seconds	15	24
or for as long as you can	(38.46)	(61.54)
Open the DPI and dispose the	32	7
empty capsule	(82.05)	(17.95)

Details regarding type and pattern of inhaler use, type of medication used in it, and other routine practices related to inhaler use were also collected and analyzed. (Table 2)

Mean duration since the initiation of inhalers among the study population was found to be 8.042±7.32 years. Spacers were used by 10% of the participants. Among the 120 inhaler users, 72.22% carry their inhaler in their bag and 27.77% carry their inhaler in a box. While not carrying along with them, the common places used as storage of inhalers included shelves, TV stand, near or on their bed, inside bags and inside tables or cupboards.

Out of the 29 participants who have missed or stopped taking their regular dose of medication in the past 1 month, 17% did so because they felt better. Financial constraints (28%), personal inconvenience (28%) and forgetfulness (27%) were the reasons cited by rest of them.

Check lists prepared based on steps followed in using MDI and DPI according to the NIH guidelines and Netherlands Asthma foundation checklist respectively were used for assessing the technique of inhaler use by the participants (Table 3, 4).

Among MDI users, only 8.64% of them performed all the steps correctly according to NIH guidelines regarding proper technique of inhaler use. Among the 39 patients who used dry powder Inhaler, 33% correctly performed all the steps according to the guidelines.

DISCUSSION

Proper technique of using inhalers were practiced by only 8.64% of MDI users and 33% of DPI users which is a low proportion. In a study done by Sebajpal in Jaipur, only 21.01% performed correct method of inhaler use. It was much lower (14%) in a study done by Mandeep Kaur. 9-11

The proportion of patients using proper inhaler technique was 22% for MDI and 30.4% for DPI users in a study from Vietnam. 12

In the current study, 68% participants were MDI users and 32% used DPI. In a study from Vietnam, majority of 94.2% were MDI users. 12 Most of the participants in the study were unemployed and financial constraints prevented them from using inhalers regularly as they could not afford to buy them regularly. Exhaling before the use of inhalers was correctly done by 91.9% of the participants while 76.5% did the step incorrectly in another study from Nepal and most of the patients were reported to have done the step incorrectly in a study from Thailand. 13,14 In a study done in Rajasthan 65% committed mistake while doing this step.9 The most frequently performed incorrect step was shaking the inhaler thoroughly in the Thailand study but majority of the study participants in this study did that step properly. 14

Among MDI users Place mouth piece between teeth and close lips without leaving any gap, Release one dose while simultaneously breathing in, Remove inhaler and close mouth immediately and Wait for at least one minute before taking the next dose were properly done by majority of the study participants compared to Nepal study. In studies done by jai Bharat Muller Patter and P Ravikumar, these critical steps in inhalation and drug delivery were wrongly done. Holding breath for 10 seconds after inhaling was properly done by 48.1% which is in line with 46.9% in the study from Nepal. But only 11.7% held their breath for 10 seconds in the study from Thailand. This low prevalence may be attributed to poor quality of instructions and lack of supervision by the health care providers.

In this study, among the DPI users, 87.18% held the inhaler vertically. In a study from Netherlands, only 63% did this step correctly, while 99% DPI users in study from Nepal correctly did this technique.16 Likewise, opening the inhaler and disposing empty capsule was done correctly by 97.5% in study from Nepal which was high compared to 82.05% in our study.¹³

These differences in the techniques followed during inhaler use in these studies may be due to difference in socio demographic characteristics of the study participants and awareness and training provided through the health care facilities regarding inhaler use that can influence the patient's inhaler practice later on. The difference in data collection technique, sample size calculation and sampling techniques may also attribute to this difference.

CONCLUSION

The knowledge regarding proper use of inhalers was very low in this study. Improper use of inhalers can lead to prolonged use of medication, increase in dose and conditions like oral candidiasis. Moreover improper treatment can also lead to worsening of the disease condition. So health care workers should take measures to ensure that the patients on inhalers are aware of the proper technique and are following the steps in using inhalers properly, hence while prescribing inhalers patients should be properly followed up and with the help of checklist they should be trained to do the steps properly by health care provider through demonstrating the technique or showing them videos that teach proper techniques of inhaler use. Providing them with handout containing the steps and check list is also a possible method to improve efficacy of aerosol therapy in these chronic respiratory illnesses.

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