

Knowledge and Practice of Dry Powder Inhalation Among Patients with Chronic Obstructive Pulmonary Disease: An Institutional Based Study

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ABSTRACT

Introduction: The disease entities like Bronchial Asthma and Chronic Obstructive Pulmonary Disease (COPD) are the two chronic lung diseases that are greatly prevalent globally. The major types of inhalers that are commonly in use include Metered Dose Inhalers (MDI) and Dry Powder inhalers (DPI). MDI are devices that are made to deliver a specified amount of medication to the lungs when inhaled, in the form of short blasts of aerosolized medicine. It is designed to be self-administered by the patient. DPI sends the medication to the lungs in the form of dry powder.

Materials and Methodology: The study is designed to be a hospital-based cross-sectional study and the study population were the patients who were diagnosed positive for COPD (the ratio of FEV1 to forced vital capacity <0.70 on the spirometry after inhalation of bronchodilator) by physicians and whose medical card denotes the final diagnosis as COPD and attending medical outpatient department (OPD) or those admitted in medical ward in the hospital and who had been under dry powder inhalation with a rotahaler as the treatment option to be followed prior to the date of data collection. The exclusion criteria include those who did not provide the consent for the study purpose, those with other obstructive lung diseases like asthma, bronchiectasis or cystic fibrosis. The sample size was on a single population estimation formula.

Results: The practice of dry powder inhalation was statistically significant with age of the rotahaler users ($p=0.009$). Patients up to the age of 60 years demonstrated the correct use of the rotahaler compared with those >60 years of age. Similarly, practice was significantly associated with the place of residence ($p=0.025$). Those who were from urban areas practiced inhalation technique more correctly than those from rural area. Education of the patients was significantly associated with practice of rotahaler; literate patients performed the inhalation technique more correctly than illiterate ones ($p=0.014$). There is statistically significant association of

practice of dry powder inhalation with a demonstration of dry powder inhalation by health care providers ($p=0.001$). Those who received a demonstration on the use of the rotahaler from health care providers performed the inhalation more accurately than those who did not.

Conclusion: COPD patients who were using the rotahaler and attending our hospital possessed a satisfactory level of knowledge and poor practice of dry powder inhalation. Regarding their practice, the most commonly committed error among rotahaler users is not exhaling prior to inhalation followed by the inability to hold one's breath for 10 seconds. However, practice of essential items of the inhalation procedure is better when compared with the practice of all of total items. A poor practice of dry powder inhalation is linked to the elderly age group, illiteracy, rural area of residence, and no demonstration on the inhalation technique by health care providers. The poor level of knowledge and practice of dry powder inhalation thus revealed a serious concern to be considered for the effective treatment of COPD.

Keywords: COPD, Dry Powder, Inhalation.


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INTRODUCTION

The disease entities like Bronchial Asthma and Chronic Obstructive Pulmonary Disease (COPD) are the two chronic lung diseases that are greatly prevalent globally. Almost over 300 million people in the world are at the moment suffering from

Bronchial Asthma and also the disease burden of COPD is more than 210 million worldwide.¹ The incorporation of inhalers as a part of aerosol therapy are considered as one of the best choices in the treatment of both these iniquities. Since they are

inexpensive, comfortable to use, portable, hand-held and provide rapid action locally with less reported systemic side effects. The major types of inhalers that are commonly in use include Metered Dose Inhalers (MDI) and Dry Powder inhalers (DPI).

MDI are devices that are made to deliver a specified amount of medication to the lungs when inhaled, in the form of short blasts of aerosolized medicine. The medicine is enclosed in a small canister inside a plastic case and when inhaler is pressed, a pre-weighed dose of medicine comes out through the mouthpiece. It is designed to be self-administered by the patient. DPI sends the medication to the lungs in the form of dry powder. The inhaler is activated by the patient's breath and the medication is released only when you take a deep sudden breath through it.²

Both MDI and DPI have their own demerits as well. Inhalers usually require some amount inspiratory flow to activate the medicine and thus making them less ideal during flare-ups of the conditions or during late stages of COPD. It might be cumbersome for young children, mentally challenged and the elderly to follow the instructed steps in administering it.

Some of the most common errors that might be made by patients in the method of its 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, improper waiting time between puffs and not holding the breath for some time after taking the puff.³⁻⁶

The Aerosol therapy is reported to be the main asset in the treatment of COPD has many advantages as well over oral intake. Since inhalation enhances the supply of drugs directly to the affected site and has fewer reported adverse effects. Additionally, the onset of action of the drug is rapid and a relatively smaller dose of the drug is required to achieve the required therapeutic effect.⁷ Although following a correct inhalation technique is mandatory to achieve the effectiveness of the drug, a large group of patients who are undergoing inhalation treatment through the use of a rotahaler are in the verge of not following the proper inhalation technique. A systematic study has shown that poor inhalation technique ranges from 4% to 94%. The outcome of this resulted in frequent COPD exacerbations, hospital admissions and economic burden.⁸ Studies have shown that various factors affect the inhalation technique of patients. These include their age, sex, educational status, occupation, area of residence, duration of disease, associated comorbid conditions, poor inhalation instruction, and poor monitoring of the inhalation technique of the patients.⁹

With this bird's eye view on the facts obtained from the earlier studies, the present study was undertaken to assess the level of knowledge and practice of dry powder inhalation among COPD patients in a regional-level hospital.

MATERIALS AND METHODOLOGY

The study is designed to be a hospital-based cross-sectional study and the study population were the patients who were diagnosed positive for COPD (the ratio of FEV1 to forced vital capacity <0.70 on the spirometry after inhalation of bronchodilator) by physicians and whose medical card denotes the final diagnosis as COPD and attending medical outpatient department (OPD) or those admitted in medical ward in the hospital and who had been under dry powder inhalation with a rotahaler as the treatment option to be followed prior to the date of data collection. The

exclusion criteria include those who did not provide the consent for the study purpose, those with other obstructive lung diseases like asthma, bronchiectasis or cystic fibrosis.

The sample size was on a single population estimation formula Assuming the prevalence of correct DPI (rotahaler) use among COPD patients, with allowable error of 5% at 95% CI, and adding 10% non-response rate and the final sample size was set at 210.

Data were collected from the available medical records by the researcher. An exit interview technique was followed for effective data collection. The patients who were exited from the OPD and who were diagnosed as COPD patients and had been using a rotahaler were identified based on the examination card and required diagnostic tests were carried out. The purpose of the study was clearly explained and informed verbal and written consent was priorly obtained with information about the nature of the study and the role of the study participants included in the study. Thumb prints were taken from the illiterate respondents after the verbal consent.

The questionnaire was the provided by the interviewer in a separate room in the OPD. Regarding knowledge, the frequency of correct answer on each question was given the score of 1. Then, assessment of the dry powder inhalation technique was conducted using the rotahaler with placebo rotacaps in the same room.

The collected data were organized, coded and entered in SPSS software, version 16. The data were then analysed by using descriptive statistical values such as frequency, percentage, mean and standard deviation to evaluate the socio-demographic information, knowledge and practice of rotahaler. Analysis of inferences was conducted using a chi-square test to assess the association of practice of rotahaler with socio-demographic characteristics and health care provider-related aspects.

RESULTS

Table – 1 showed that the study has nearly half (49%) of the rotahaler users belonged to the 61–70 years age group. The overall mean and SD of the age of those users was 67.22±9.92. More than half of the COPD patients using rotahalers were females (53.8%) and from rural areas (54.7%). More than two-thirds of them were illiterate (68%) and unemployed (65.7%). Among the literates, the maximum number (47.6%) of DPI users had basic education. The majority (48%) of the respondents had used the rotahaler for less than a year.

Regarding the instructions given, nearly all (98%) of the rotahaler users got verbal instruction regarding the use of the rotahaler. However, only 14.2% of the respondents had observed a demonstration of dry powder inhalation from health care providers. Around 2.3% of the respondents were given an opportunity for re-demonstration and were observed doing re-demonstration by the care providers at their first use of the rotahaler; however, none of them were rechecked on their inhalation technique during their follow-up visits as tabulated in Table - 2.

The majority of the DPI users (89.2%) had gained enough knowledge about the storage of rotacaps. They were aware that rotacaps should be kept in a cool place away from moisture, and fourfifths of them (80.4%) were aware that they should take a slow deep breath while inhaling the drug. However, only 11.7% of them possessed the correct knowledge on holding breath for 10 seconds after deep inhalation of the drug (Table 3).

The practice of dry powder inhalation was statistically significant with age of the rotahaler users ($p=0.009$). Patients up to the age of 60 years demonstrated the correct use of the rotahaler compared with those >60 years of age. Similarly, practice was significantly associated with the place of residence ($p=0.025$). Those who were from urban areas practiced inhalation technique more correctly than those from rural area. Education of the patients was significantly associated with practice of rotahaler; literate patients performed the inhalation technique more correctly

than illiterate ones ($p=0.014$). However, no significant association was observed in the practice of DPI in terms of sex ($p=0.293$), employment status ($p=0.123$) and years of use of rotahaler ($p=0.852$) (Table 4). There is statistically significant association of practice of dry powder inhalation with a demonstration of dry powder inhalation by health care providers ($p=0.001$). Those who received a demonstration on the use of the rotahaler from health care providers performed the inhalation more accurately than those who did not (Table 5).

Table 1: Background characteristics of patients using rotahaler

Background characteristics	Number	Percentage
Age (years)		
Upto 60	42	20
61 – 70	103	49
71 – 80	44	20.9
More than 81	21	10
Sex		
Male	97	46.1
Female	113	53.8
Residence		
Rural	115	54.7
Urban	95	45.2
Educational status		
Illiterate	143	68
Literate	67	31.9
Employment status		
Unemployed	138	65.7
Employed	72	34.2
Duration of rotahaler use		
Less than 1 year	100	47.6
1 – 5 years	75	35.7
More than 5 years	35	16.6

Table 2: Health care provider-related factors affecting knowledge and practice of dry powder inhalation among COPD patients

Factors with health care providers on dry powder use	Number	Percentage
Verbal instructions		
Received verbal instructions	206	98
Not received verbal instructions	4	1.9
Observed demonstrations		
Observed	30	14.2
Not observed	180	85.7
Performed re-demonstration		
Performed	5	2.3
Not performed	205	97.6
Re-demonstration on each visit		
Performed	0	0
Not performed	210	100

Table 3: Knowledge about dry powder inhalation among COPD patients

Knowledge aspect	Score	Percentage
Site of rotacaps storage	185	88
Breathing nature during inhalation	167	79.5
Head position during inhalation	38	18
Breath holding during inhalation	27	12.8
Cleaning of rotahaler	135	64.2

Table 4: Association between background variables and the practice of dry powder inhalation among COPD patients

Variables	Practice		P – value
	Correct	Incorrect	
Age (years)			
Upto 60	6	37	0.009
Above 60	5	163	
Sex			
Male	4	93	0.293
Female	8	105	
Residence			
Rural	2	113	0.025
Urban	9	86	
Educational status			
Illiterate	3	140	0.014
Literate	8	59	
Employment status			
Unemployed	5	133	0.125
Employed	6	66	
Duration of rotahaler use			
Less than 1 year	5	95	0.852
1 year or above	7	68	

Table 5: Association between health care provider-related factors and the practice of dry powder inhalation among COPD patients

Care provider related factors	Practice		P - value
	Correct	Incorrect	
Obtained verbal instructions			
Obtained	10	196	-
Not obtained	0	4	
Demonstration			
Obtained	8	22	<0.001
Not obtained	3	177	

DISCUSSION

However, in this study, the results regarding knowledge and practice are quite shocking since the majority of the rotahaler users possessed satisfactory knowledge on the rotahaler and its use, whereas 96.1% of those users had followed the improper or incorrect inhalation techniques. This could have happened because of the poor instructions from health care providers, lack of questioning attitude in study participants and their negligence or inability to read the instruction provided on the leaflet present in the drug packaging. The majority of rotahaler users (96.1%) could not correctly follow all the steps of dry powder inhalation through the rotahaler. Regarding the essential items, 77.5% of the users performed all the essential steps correctly. The least correctly performed step according to the Dutch Asthma Foundation checklist for rotahaler was while taking the second breath, which is a combination of the following steps: exhaling to residual volume, keeping mouthpiece between teeth and lips, breathing in again, and holding breath for 10 seconds (4.9%).

Regarding the single step, most commonly committed error was not being able to exhale to residual volume (76.5%). Similar results have been reported in other studies.^{10,11,12,13} The second most commonly committed error was not being able to hold one's breath for 10 seconds (64.1%). This result can be attributed to poor instruction, and a lack of supervision and follow-up check on

dry powder inhalation technique by health care providers, the quality of instruction from the health care providers, and their emphasis on item skills. In regard to the essential items, the most frequently committed error was in the step, inhale forcefully and deeply.^{10,13,14} This error halts the deposition of inhaled drug into the lungs, resulting in poor treatment outcome. However, this result contrasts with the study by *van der Palen* et al, which observed that the most common error was keeping the rotahaler in upright position.¹² This inconsistency may be attributed with the quality of instruction from the health care providers and their emphasis on item skills. Regarding practice, the correct use was associated with younger age ($p=0.008$),^{10,14-16} an urban area of residence ($p=0.024$) and literacy ($p=0.012$).^{10,16} Poor coordination and decline in cognition with increasing age may have resulted in a poor inhalation technique. Thus, the elderly population might require frequent monitoring and reinforcing training on inhalation technique. Similarly, the quality of health care services may be poor among the rural residents, leading to poor knowledge and practice of inhalation technique. In regard to education, higher level of education may have increased better understanding, confidence, and critical analysis, which, in turn, could enhance better learning of the inhalation techniques. Likewise, poor inhalation technique in this study was significantly associated with

no practical class/demonstration on dry powder inhalation by health care providers ($p < 0.001$)^{17,18}. This result signifies the need for health care personnel to practically demonstrate the technique for dry powder inhalation and conduct re-demonstrations from the patients at each visit to ensure that the patients are taking the drugs accurately, and the best results of the treatment can be achieved.

CONCLUSION

To conclude, COPD patients who were using the rotahaler and attending our hospital possessed a satisfactory level of knowledge and poor practice of dry powder inhalation. Regarding their practice, the most commonly committed error among rotahaler users is not exhaling prior to inhalation followed by the inability to hold one's breath for 10 seconds.

However, practice of essential items of the inhalation procedure is better when compared with the practice of all of total items. A poor practice of dry powder inhalation is linked to the elderly age group, illiteracy, rural area of residence, and no demonstration on the inhalation technique by health care providers. The poor level of knowledge and practice of dry powder inhalation thus revealed a serious concern to be considered for the effective treatment of COPD.

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