

Original research article

Dry Powder Inhalation Knowledge and Practices Among COPD Patients in Bihar: A Questionnaire Based Study

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Abstract

Aim: Study of knowledge and practice of dry powder inhalation among patients with chronic obstructive pulmonary disease in Bihar region.

Methods: A cross-sectional study was conducted in the Department of Medicine, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India for 1 year. Total 100 patients diagnosed COPD, who had been using a rota haler since the last 1 month was identified using the examination card and the laboratory and radiological findings of the patients. The questionnaire was administered by the interviewer in a separate room in the OPD (between the OPD time of 9 am and 2 pm). 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 rota haler with placebo rota caps in the same room.

Results: The overall mean and SD of the age of those users was 68.22 \pm 8.92. Regarding instruction, nearly all (99%) of the rota haler users got verbal instruction regarding the use of the rota haler. However, only 13% of the respondents had observed a demonstration of dry powder inhalation from health care providers. The majority of the DPI users (89%) had correct knowledge about the storage of rota caps. They were aware that rota caps should be kept in a cool place away from moisture, and four-fifths of them (80%) were aware that they should take a slow deep breath while inhaling the drug. However, only 12% of them possessed the correct knowledge on holding breath for 10 seconds after deep inhalation of the drug. Regarding practice, the item most correctly performed by the rota haler users was keeping the Rotacap horizontal (99%) followed by keeping the rota haler upright (99%) and opening the rota haler and discarding the empty capsule (97%). In respect to all the steps of the dry powder inhalation, a minority (4%) of the patients demonstrated the use of the rota haler correctly, while most of them (96%) performed the steps incorrectly. There is statistically significant association of practice of dry powder inhalation with a demonstration of dry powder inhalation by health care providers ($p=0.001$).

Conclusion: It is concluded that COPD patients using the Rota haler and attending our Hospital possessed a satisfactory level of knowledge and poor practice of dry powder inhalation. Regarding practice, the most commonly performed error among Rota haler users is not exhaling prior to inhalation followed by the inability to hold one's breath for 10 seconds.

Keywords: Rota haler, dry powder, inhalation

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.³⁻⁶

Materials and Methods

A cross-sectional study was conducted in the Department of Medicine, Darbhanga Medical College and Hospital, Laheriasarai, Darbhanga, Bihar, India for 1 year, after taking the approval of the protocol review committee and institutional ethics committee.

100 patients who were those diagnosed with COPD (post-bronchodilator forced expiratory volume in 1 second [FEV1] <80% and the ratio of FEV1 to forced vital capacity <.070 on spirometry after the inhalation of bronchodilator) by physicians whose medical examination card notes the final diagnosis as COPD and attending medical outpatient department (OPD) or those admitted in medical ward of our hospital aged ≥ 20 , and who had been taking dry powder inhalation with a rota haler as the treatment prior to the date of data collection. From these patients, those who did not consent to participate in the study and/or who had other obstructive diseases (asthma, bronchiectasis, and cystic fibrosis) were excluded from the study.

Adult patients diagnosed COPD, who had been using a Rota haler since the last 1 month were identified using the examination card and the laboratory and radiological findings of the patients. They were then consecutively selected and enrolled in the study

An exit interview technique was adopted for data collection. The patients who exited from the OPD and who were COPD patients who had been using a Rota haler were identified through the examination card and diagnostic tests carried out. The purpose of the study was explained, and informed verbal and written consent was collected with information about the nature of the study and the participants' role in the research. Finger prints were taken from the illiterate respondents after the verbal consent. The questionnaire was administered by the interviewer in a separate room in the OPD (between the OPD time of 9 am and 2 pm). 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 Rota haler with placebo Rotacap in the same room. A similar assessment was carried out in the ward at the bedside of the patients (before 9 am and after 2 pm). Practice was examined using the rotahaler checklist developed by the Dutch Asthma Foundation. The performance of each of the steps of rotahaler use was labeled a correct inhalation technique if the respondent correctly performed each of the steps of the checklist. The performance was labeled incorrect if the patient could not perform the steps correctly and/or missed some of the steps. After examination of the inhalation technique, the incorrect method adopted by the patient was explained to the patient. After that, the patients were shown a video of the correct inhalation technique.

Results

The study showed that nearly half (50%) of the rotahaler users belonged to the 61–70 years age group. The overall mean and SD of the age of those users was 68.22 ± 8.92. More than half of the COPD patients using rotahalers were females (54%) and from rural areas (55%). More than two-thirds of them were illiterate (69%) and unemployed (66%). Among the literates, the maximum number (42%) of DPI users had basic education. The majority (49%) of the respondents had used the rotahaler for less than a year (Table 1)

Regarding instruction, nearly all (99%) of the rotahaler users got verbal instruction regarding the use of the rotahaler. However, only 13% of the respondents had observed a demonstration of dry powder inhalation from health care providers. Less than 1% 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 (Table 2).

The majority of the DPI users (89%) had correct knowledge about the storage of rotacap. They were aware that rotacaps should be kept in a cool place away from moisture, and four-fifths of them (80%) were aware that they should take a slow deep breath while inhaling the drug. However, only 12% of them possessed the correct knowledge on holding breath for 10 seconds after deep inhalation of the drug (Table 3).

Regarding practice, the item most correctly performed by the rotahaler users was keeping the Rotacap horizontal (99%) followed by keeping the rotahaler upright (99%) and opening the rotahaler and discarding the empty capsule (97%). In contrast, the least correctly performed step was breathing in again and holding the breathe for 10 seconds (5%), which is also a combination of steps. In regard to the single step, the most frequently committed error was exhaling to residual volume (77%) followed by holding the breath for 10 seconds (64%) (Table 4). Regarding the essential steps, the majority of the COPD patients correctly performed the step “Keep rotahaler upright” (99%) followed by “Rotate both ends to open the capsulet” (95%) (Table 4). Most of the patients (78%) performed all the essential items correctly. However, 22% of them could not correctly perform 1 or more of the crucial steps.

In respect to all the steps of the dry powder inhalation, a minority (4%) of the patients demonstrated the use of the rotahaler correctly, while most of them (96%) performed the steps incorrectly (Table 4).

The practice of dry powder inhalation was statistically significant with age of the rotahaler users ($p=0.007$). 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 ($p=0.021$). 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 ($p=0.24$), employment status ($p=0.13$) and years of use of rotahaler ($p=0.73$). There is statistically significant association of practice of dry powder inhalation with a demonstration of dry powder inhalation by health care providers ($p=0.001$).

Table 1: Background characteristics of patients using rotahaler

| Background characteristics | Number | Percentage |
|-----------------------------------|--------|------------|
| Age (years) | | |
| Up to 60 | 20 | 20 |
| 61–70 | 50 | 50 |
| 71–80 | 20 | 20 |
| 81 years and above | 10 | 10 |
| Sex | | |
| Male | 46 | 46 |
| Female | 54 | 54 |
| Place of Residence | | |
| Rural | 55 | 55 |
| Urban | 45 | 45 |
| Education Status | | |
| Illiterate | 69 | 69 |
| Literate | 31 | 31 |
| If literate | | |
| Can read and write only | 38 | 38 |
| Basic education (grade 1–8) | 42 | 42 |
| Secondary education (grade 9–12) | 12 | 12 |
| Higher education (above grade 12) | 8 | 8 |
| Employment status | | |
| Unemployed | 66 | 66 |
| Employed | 64 | 64 |
| Years of use of rotahaler | | |
| Less than 1 year | 49 | 49 |
| 1–5 years | 35 | 35 |
| More than 5 years | 16 | 16 |

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

| Health care provider related factors | Number | Percentage |
|--|--------|------------|
| Verbal instruction on dry powder inhalation use | | |
| Received verbal instruction | 99 | 99 |
| Not received verbal instruction | 1 | 1 |
| Observed demonstration of rotahaler use | | |
| Observed demonstration | 13 | 13 |

| | | |
|---|-----|-------|
| Not observed demonstration | 87 | 87 |
| Performed re-demonstration | | |
| Performed | 1 | 1 |
| Not performed | 99 | 99 |
| Re-demonstration of rotahaler use by patient on each visit | | |
| Performed | | – |
| Not performed | 204 | 100.0 |

Table 3: Knowledge about dry powder inhalation among COPD patients

| Aspects of knowledge | Correct item Score | Correct item percentage |
|--|--------------------|-------------------------|
| Site of storage of rotacaps | 89 | 89 |
| Nature of breathing during inhalation | 80 | 80 |
| Percentage of drug that reaches the lung | 17 | 17 |
| Position of head during inhalation of drug | 25 | 25 |
| Holding of breath after inhalation | 12 | 12 |
| Cleaning of rotahaler | 44 | 44 |

Table 4: Stepwise practice of dry powder inhalation through the rotahaler among COPD patients

| Steps | No. of correct responses | Percentage |
|---|--------------------------|------------|
| Keep rotahaler upright* | 99 | 99 |
| Insert rotacap with transparent end down | 93 | 93 |
| Keep rotacap horizontal | 99 | 99 |
| Rotate both ends to open the capsulet* | 95 | 95 |
| Exhale to residual volume | 23 | 23 |
| Keep rotahaler vertical | 97 | 97 |
| Keep mouthpiece between the teeth | 84 | 84 |
| Slightly extend the head | 45 | 45 |
| Inhale forcefully and deeply* | 82 | 82 |
| Hold breath for 10 seconds | 36 | 36 |
| Exhale away from the mouthpiece | 83 | 83 |
| If powder still remains inside rotahaler, breathe in again and hold breath for 10 seconds | 5 | 5 |
| Open the rotahaler and discard the empty capsule | 98 | 98 |

Discussion

In this study, the results regarding knowledge and practice are quite alarming, as the majority of the rotahaler users possessed satisfactory knowledge on the rotahaler and its use, whereas 96% of those users performed the inhalation technique incorrectly. This could have occurred because of the poor instruction from health care providers, lack of questioning attitude in

Nepalese patients, and their negligence or inability to read the instruction leaflet provided in the drug box.

The majority of rotahaler users (96%) could not correctly complete all the steps of dry powder inhalation through the rotahaler. Regarding the essential items, 78% 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 (5%). Regarding the single step, most commonly committed error was not being able to exhale to residual volume (77%). Similar results have been reported in other studies.⁷⁻¹²

The second most frequently committed error was not being able to hold one's breath for 10 seconds (64%). 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.^{12,13} 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 showed that the most frequent error was keeping the rotahaler upright.¹¹ This inconsistency may be associated 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 ($p=0.008$),^{7,13-15} an urban area of residence ($p=0.021$),⁹ and literacy ($p=0.014$)^{7,9,15-18}. Poor coordination and decline in cognition with increasing age may have resulted in a poor inhalation technique. Therefore, the elderly population required frequent checking and training of 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.

Similarly, poor inhalation technique in this study was significantly associated with no practical class/demonstration on dry powder inhalation by health care providers ($p=0.001$).^{8-11,16-19}

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

It is concluded that COPD patients using the rotahaler and attending our Hospital possessed a satisfactory level of knowledge and poor practice of dry powder inhalation. Regarding practice, the most commonly performed 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 compared with the practice of all of total items.

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