

Assessment of rotahaler inhalation technique among patients with chronic obstructive pulmonary disease in a teaching hospital of Nepal

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Abstract

Background: Inhalation mode of drug delivery is the mainstay treatment for chronic obstructive pulmonary disease, however; incorrect technique prevents patients from receiving maximal therapeutic benefits.

Objectives: To assess usage technique of rotahaler among patients with chronic obstructive pulmonary disease and identify factors affecting its performance.

Methods: Descriptive cross sectional study was conducted to assess rotahaler (single unit dose dry powder inhaler) inhalation technique among patients with chronic obstructive pulmonary disease in Kathmandu University Teaching Hospital. The study population consisted of 100 respondents using rotahaler for at least one year. Data collection was done by standard checklist, semi structured questionnaire via observation and interview methods respectively.

Results: Correct inhalation technique was found in 37% of total respondents. Nearly two out of three respondents (61%) failed to breathe out deeply before inhaling. Majority of the respondents (59%) failed to hold breath for at least 10 second and 25% were unable to breathe in deeply. Age, occupation, source of inhalation instruction and re-demonstration of the technique were found to be significantly associated with the correct inhalation technique ($p < 0.05$).

Conclusion: More than half of the respondents had incorrect inhalation technique, so health education program targeting the common identified errors should be carried out. Arrangements should be made for regular involvement of pharmacist in teaching and re-demonstration to ensure good inhaler technique. This would ultimately lead to a greater clinical response and improved patient compliance.

Key words: Inhaler, Inhalation Technique, Rotahaler

INTRODUCTION

Globally 10-20% of population older than 40 years is suffering from chronic obstructive pulmonary disease and three million die each year¹. Chronic obstructive pulmonary disease (COPD) is projected to be the third leading cause of death by 2020^{2,3}. Rotahaler was designed to make inhaled medication more convenient and effective. Improving success in inhalation is not only a matter of inhaler design but also of optimizing and simplifying instructions⁴. Recent clinical studies showed that many users use inhaler incorrectly even after instruction and correct technique deteriorates over time^{5,6}. Patients may face challenges to use dry powder

inhalers (DPI) because of age, co morbid conditions, personal perceptions and beliefs about therapy⁷.

Studies have demonstrated that inefficient inhaler technique is a common problem resulting in poor drug delivery, decreased disease control, non-compliance and decrease inhaler use⁸. Though inhaler technique is crucial, it is poorly recognized and instruction is not given adequately resulting in suboptimum control of disease.

The purpose of this study was to find out the technique of using rotahaler and identify the factors associated with inhalation technique.

METHODS

A hospital based descriptive cross-sectional study was used to assess the rotahaler inhalation technique and identify the factors associated with its correct

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performance. Clients (both inpatients and outpatients at Kathmandu University Teaching Hospital (KUTH) who were diagnosed with COPD and using rotahaler for at least one year were taken as the study units. Dhulikhel Hospital (DH) is the teaching hospital of Kathmandu University and it was selected as per the convenience of researcher. Pretesting was done with ten samples and questionnaires were finalized with some modifications. Purposive consecutive sampling was done to include the total respondents meeting the eligibility criteria and available during the period of data collection that is four weeks.

Data collection tools: Semi-structured questionnaire was used to assess socio-demographic characteristics like age education, occupation, fuel for cooking and practice related variables like duration of use, demonstration and re-demonstration of use, etc.

Observational checklist was used to assess inhalation technique. It includes the steps given by Lung association⁹ and package leaflet (Cipla)[®] which includes seven steps like unscrew the cover and hold the rotahaler vertically, press the rotacap firmly such that top end of rotacap is in level with the top of the hole, hold the mouthpiece firmly with one hand, rotate its base, breathe out gently and avoid breathing inside the inhaler, grip mouthpiece between the teeth and seal with the lips around it, breathe in through the mouth as deeply as you can, remove the rotahaler from mouth and hold the breath for at least 10 seconds or as long as you feel comfortable and exhale out and repeat above steps if more than one dose required.

Principal Outcome Measure: If the respondents perform essential steps like holding mouthpiece firmly, seal the mouthpiece with teeth, deep inhalation, holding breath for as long as you can then they were coded as having correct technique and those who failed to perform all or at least any one of these steps were designated of having incorrect inhalation technique⁹.

Data collection was done from the period of May 2009 to July 2009, where COPD clients meeting the inclusion criteria were interviewed. Total 115 eligible respondents were approached for the interview, however only hundred respondents completed the interview and demonstrated the rotahaler inhalation technique. Hence, those 100 respondents were only included in the analysis and it gave the response rate of 87%. After completion of data collection, every respondent was shown the correct inhalation technique by researcher

and were asked to re-demonstrate the process. It helped to reinforce and update the correct technique while rectifying common mistakes done by respondents.

After collecting the data, it was checked thoroughly to ensure accuracy and completeness. Data analysis involved editing, tabulation, comparison and interpretation. Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 16.

Statistical Analysis: Descriptive statistics like frequency mean and percentage were used to present the socio-demographic characteristics of the study population and inhalation technique. Bivariate analysis (chi-square test) was used to show the statistical association between various factors and rotahaler inhalation technique.

The ethical clearance was obtained from Institutional Ethical Review Board of Dhulikhel Hospital, Kavre. Informed (verbal) consent was taken for participation. Respondents were fully informed about the purpose and nature of study and they were informed that they can terminate interview whenever they want to. Confidentiality and anonymity was maintained.

RESULTS

One hundred patients were involved in the study (41 male and 59 female) with mean age 63.44 ± 9.73 years. Among them 41% were literate and 59% illiterate and significantly large proportion (80%) were engaged in household activities.

Assessment of rotahaler inhalation technique

Table 1 summarized the stepwise inhalation technique of each respondent when they were asked to show the technique of using the rotahaler in front of researcher. The technique was assessed with reference to the standard guidelines⁹. Common steps missed by 61 (61%) of respondents was not breathing out fully which was followed by 10 (10%) of the respondents who missed to rotate the base of rotahaler. More than half of respondents (59%) failed to hold their breath after inhalation and one quarter (25%) of respondents were unable to breathe in through the mouth deeply and to a similar proportion exhale into the device. It can be seen that 11 percent of respondents put the rotacap into device after breaking it.

Respondents' rotahaler inhalation technique

Majority of respondents (63%) had incorrect rotahaler inhalation technique while only 37 percent showed the correct technique.

Practice regarding care of rotahaler after use

When respondents were asked about care of rotahaler after use, it was found that large numbers of respondents (88%) clean their rotahaler after use and almost half of them (49%) rinse their mouth after use. Regarding the way of cleaning the rotahaler, 53 percent reported that they cleaned it with tap water (Table 2).

Association of socio-demographic characteristics and inhalation technique

Chi-square test was done to see the association of various socio-demographic variables and inhalation technique. Respondents' age and occupation was found to be significantly associated with inhalation technique. Respondents' having age less than 60 years were more likely to have correct inhalation technique than respondents having age more than 60 years [Crude Odds Ratio (COR) =3.32, 95% ; confidence interval (CI) :

1.38-7.97]. Similarly, respondents' engaged in household activities were less likely to demonstrate correct inhalation technique than those engaged in service or outdoor works (COR=0.30, 95% CI: 0.11-0.84) (Table 3).

Association of practice related variables and inhalation technique

Source of inhalation instruction and re-demonstration of technique by respondents were found to be significantly associated with inhalation technique. Compared to pharmacist, those respondents, who were given instruction by nurses were less likely to have correct inhalation technique (COR=0.35, 95% CI: 0.12 -1.00). It was found that the respondents who had re demonstrated the inhalation technique in front of instructors were more likely to have correct technique than those who didn't (COR=2.67, 95% CI: 1.16– 6.61). (Table 4)

Table 1: Assessment of rotahaler inhalation technique (n=100)

| Steps of rotahaler inhalation technique | Correct Frequency (Percentage) | Incorrect Frequency (Percentage) | Missed Frequency (Percentage) |
|--|--------------------------------|----------------------------------|-------------------------------|
| Unscrew the cover and hold the rotahaler vertically. | 100 (100) | - | - |
| Press the rotacap firmly such that top end of rotacap is in level with the top of the hole. | 89 (89) | 11 (11) | - |
| Holding the mouthpiece firmly with one hand, rotate its base. | 89 (89) | 1 (1) | 10 (10) |
| Breathe out gently and avoid breathing inside the inhaler. | 33 (33) | 6 (6) | 61 (61) |
| Grip mouthpiece between the teeth and seal with the lips around it. | 91 (91) | 9 (9) | - |
| Breathe in through the mouth as deeply as you can. | 75 (75) | 25 (25) | - |
| Remove the rotahaler from mouth and hold the breath for at least 10 seconds and as long as you feel comfortable. | 41 (41) | 59 (59) | - |
| Exhale out and repeat above steps if more than one dose required. | 75 (75) | 25 (25) | - |

Number in parenthesis indicates percentage

Table 2: Practice regarding care of rotahaler after use (n=100)

| Variables | Categories | Frequency (Percentage) |
|--|--------------------------------------|------------------------|
| Clean the rotahaler after use | Yes | 88 (88.0) |
| | No | 12 (12.0) |
| Time to clean the rotahaler | After each use | 32 (32.0) |
| | Daily | 20 (20.0) |
| | No fixed schedule /as required | 20 (20.0) |
| | Twice a week | 12 (12.0) |
| Method of cleaning the rotahaler after use | Don't Know | 16 (16.0) |
| | Clean with tap water | 53 (53.0) |
| | Clean with hot water/ soap and water | 33 (33.0) |
| Rinse mouth after use | Wipe with the cloth | 27 (27.0) |
| | Yes | 49 (49.0) |
| | No | 51 (51.0) |

Table 3: Bivariate analysis of socio-demographic characteristics and inhalation technique (n=100)

| Variables | Rotahaler Inhalation Technique | | Total n (%) | p- value | COR (95% CI) |
|--|--------------------------------|-----------|-------------|----------|------------------|
| | Correct | Incorrect | | | |
| Age in years | | | | | |
| < 60 years | 18 (56.3) | 14 (43.7) | 32 (32.0) | 0.01 | 3.32 (1.38-7.97) |
| ≥ 60 years | 19 (27.9) | 49(72.1) | 68 (68.0) | | |
| Gender Distribution | | | | | |
| Female | 21(35.6) | 38 (64.4) | 59 (59.0) | 0.73 | 0.86 (0.38-1.97) |
| Male | 16 (39.0) | 25 (61.0) | 41(41.0) | | |
| Educational Status | | | | | |
| Literate | 17 (41.5) | 24 (58.5) | 41(41.0) | 0.44 | 1.38 (0.61-3.14) |
| Illiterate | 20 (33.9) | 39 (66.1) | 59 (59.0) | | |
| Occupation | | | | | |
| Household activities | 25 (35.6) | 55 (68.8) | 80 (80.0) | 0.02* | 0.30 (0.11-0.84) |
| Service/Labor | 12 (60.0) | 8 (40.0) | 20 (20.0) | | |
| Use of Biogas as fuel for cooking | | | | | |
| Yes | 22 (39.3) | 34 (60.7) | 56 (56.0) | 0.59 | 1.25 (0.55-2.85) |
| No | 15 (34.1) | 29 (65.9) | 44 (44.0) | | |

Number in parenthesis indicates percentage

COR stands for Crude Odds Ratio

* p-value significant <0.05

Table 4: Bivariate analysis of practice related variables and inhalation technique (n=100)

| Variables | Rotahaler inhalation technique | | Total n (%) | p- value | Crude Odds Ratio (95% CI) |
|--|--------------------------------|-----------|-------------|----------|---------------------------|
| | Correct | Incorrect | | | |
| Duration of use | | | | | |
| ≥ One year | 23 (38.3) | 37 (61.7) | 60 (60.0) | 0.74 | 1.15 (0.50-2.65) |
| < One year | 14 (35.0) | 26 (65.0) | 40 (40.0) | | |
| Source of inhalation instruction | | | | | |
| Doctors | 15 (41.7) | 21 (58.3) | 36 (36.0) | 0.61 | 0.77 (0.28-2.10) |
| Nurses | 9 (24.3) | 32 (75.7) | 41 (41.0) | 0.04 | 0.35 (0.12 -1.00) |
| Pharmacists | 13 (48.2) | 14 (51.8) | 27 (27.0) | | |
| Demonstration of inhalation technique at the time of prescription | | | | | |
| Yes | 28 (39.4) | 43 (60.6) | 71 (71.0) | 0.43 | 1.45(0.58– 3.63) |
| No | 9 (31.0) | 20 (69.0) | 29 (29.0) | | |
| Re-demonstration of inhalation technique by respondents | | | | | |
| Yes | 23 (48.9) | 24 (51.1) | 47 (47.0) | 0.02 | 2.67 (1.16– 6.61) |
| No | 14 (26.4) | 39 (73.6) | 53 (53.0) | | |
| Inhalation instruction at follow up visits | | | | | |
| Yes | 12 (50.0) | 12 (50.0) | 24 (24.0) | 0.13 | 2.04 (0.80-5.18) |
| No | 25 (32.9) | 51 (67.9) | 76 (76.0) | | |

DISCUSSION

COPD was found to be the disease most commonly occurring in elderly age group and there is incremental increase in COPD prevalence with age. Several previous studies showed that most of the COPD patients belonged to the age group 40-65 years which was in agreement with the present study^{10,11}. More than half of COPD burden were borne by females supporting the fact that most of the COPD patients are females as they

are exposed to indoor biomass fuel fires for considerably long period of time^{10,12}. World health organization (WHO) estimated that 22 percent of all COPD cases are caused by the indoor smoke from biomass fires and this study supports this statement as majority of COPD clients were involved in household activities and more than half of them reported of using biogas fuel for cooking similar to the study done at Mid-Western Regional Hospital of Nepal^{1, 10}.

DPIs are widely used in clinical practice; however, a number of studies have shown that many patients don't use inhalers correctly with figures for incorrect inhalation technique ranging from four percent to 94 percent⁶ with as many as 67 percent misusing their rotahaler¹³. The finding of the present study showed that only 37 percent use their inhalers correctly consistent to the findings of various international studies^{14,15}.

The most common errors identified were failure to exhale before actuation, failure to breath-hold after inhalation, incorrect positioning of the inhaler, incorrect rotation sequence, and failure to execute a forceful and deep inhalation⁶. Similar findings were observed in current study corroborating previously published data from several studies performed worldwide¹⁶⁻¹⁸, however, regarding cleaning and mouth rinsing after rotahaler use, our results were contradictory to former study by Kofman, 2004¹⁹. It is believed that to improve the inhalation technique, instruction should be focused on these mistakes mostly and repeated sessions should be conducted as repetition always facilitates learning. Checklist-based assessment and correction of step-by-step technique is an effective strategy for improving inhaler technique.

Similar to our findings, error rates in using inhalers increase with age as older patients may be particularly prone to lose technical skills over time^{20,21}. Overwhelmingly, a large proportion was involved in household activities and it can be hypothesized that as most of the respondents were belonging to higher age group, they were restricted to household chores. Respondents who were involved in service or outdoor works were more likely to be educated and influenced by others as they can see and learn from other users. Patients who had received repeated instruction and who had previously been asked to demonstrate the use of their inhaler during an instruction session were more likely to demonstrate correct inhalation technique consistent to our findings, however; in current study we didn't obtain significant association of inhalation technique and instruction at follow up visits as in other studies^{22,23}. Correct inhalation technique wasn't affected by gender, demonstration of technique, duration of use, and teaching at follow up visits. These findings are supported by various earlier studies^{17,24,25}.

Although all respondents reported that they had received instruction from health professionals at the time of prescription, only 37 percent demonstrated the technique correctly. Several studies have demonstrated

that community pharmacists can provide effective training in correct inhaler use which was in accordance with the findings of this study where respondents who had received instruction from nurses were less likely to show correct technique compared to those who had received instruction from pharmacists^{26,27}. A study showed that large proportion of health professionals like doctors, nurses, pharmacists (31-85%) showed incorrect technique^{20,26}. Education of health professionals significantly improves their inhaler technique, thus regular ongoing training should be given to ensure that they retain and update these skills.

This study has the limitations like small sample size, single hospital which compromise the generalization of the finding. Additionally, there might be respondent bias as they might have performed better as they were being watched which might have decreased the number of detected errors. However, attempts were made to assess the technique in natural setting.

However, this study can be an eye-opener as it concluded that in most of the patients the inhalation technique is poor and faulty. It adds to the stock of existing literatures and can facilitate to conduct further studies in this issue exploring other factors as well.

CONCLUSION

Most patients used their rotahalers incorrectly with most common errors being failure to hold the breath after inhalation and inability to take deep inspiration prior inhalation. Source of information and re-demonstration of technique was found to be significantly associated with proper use. Regular assessment and reinforcement of correct inhalation technique by health professionals and caregivers are essential to improve compliance. Further studies are recommended to assess the role of health professionals' and pharmacists in the proper use of inhalers. Pharmacists are currently less involved in patient education about inhalers use; thus their active involvement in instruction session may aid in correct usage of inhaler by patients.

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