

Evaluation of Metered Dose Inhaler Use Technique and Response to Educational Training

G.P. Jolly, A. Mohan, R. Guleria, Rosemary Poulouse and J. George

Department of Pulmonary Medicine and Sleep Disorders, All India Institute of Medical Sciences, New Delhi, India

Abstract

Background. Prescribing inhalers without imparting adequate education regarding proper technique of their usage may result in suboptimal clinical improvement and wastage of medication. Training interventions using a standard check-list may help improve faulty techniques and enhance drug efficacy.

Methods. Patients using metered dose inhaler (MDI) were included in the study. Inhaler technique was first evaluated at baseline using a standard check-list of recommended steps (National Institute of Health guidelines; see Table) and scores were given for each step correctly performed. Those who could not perform all steps correctly were given training intervention. The patients were assigned to two methods of educational intervention; one group was trained by providing written material giving step-wise instructions while the other group was given an actual physical demonstration using a placebo device. The technique was re-evaluated and scored following each educational session, and continued till the patient achieved a full score, or for a maximum of 3 sessions, whichever occurred earlier. Median score was calculated after each session and was compared between the two groups. Each patient was followed up after two months and the re-evaluated the same way.

Results. One hundred and seventeen subjects were enrolled in the study (59 in the written group and 57 in the practical demonstration group). At baseline, only 1 of the 117 subjects could perform all the steps of inhaler usage correctly. This patient was, therefore, not provided the inhaler technique education. The overall median (range) score of the whole group was 3 (range 1-8). This score rose to 6, 7 and 8 after each of the three subsequent educational intervention sessions. At one-month follow-up, the median score dropped to 7 and improved with a repeat educational session as previously done. A significant difference was observed in the median score improvement achieved in the practical demonstration group compared with the written instruction group (3.0 versus 2.0 respectively, $p < 0.001$).

Conclusions. Inhalation technique of patients improves after imparting systematic educational intervention. A practical demonstration of all the steps proved more effective than simple verbal/written advice. In view of increasing errors being committed over a period of time, repeated demonstration of the proper technique using a standard check-list significantly improves the errors committed during inhaler use. [Indian J Chest Dis Allied Sci 2015;57:17-20]

Key words: Inhaler therapy, COPD, Patient education, MDI.

Introduction

Drug administration using a metered dose inhaler (MDI) device has become the mainstay of therapy in respiratory disorders, such as asthma and chronic obstructive pulmonary disease (COPD). The advantages offered by this method are financial affordability, convenience, portability, quick and local action, and negligible systemic side effects.¹ The technique of inhalation is a major factor governing the efficiency of the inhaled medication. Correct inhalation technique is critical in ensuring optimal drug delivery to the airways, and thereby its efficacy. However, erroneous inhalation technique is very common in patients with chronic airflow obstruction,²⁻⁴ and hence, appropriate training is essential for all these patients to ensure optimal therapy.⁵⁻⁷

Previous studies have reported a high rate of inadequate inhalation technique varying from 77.5% to 89.2% depending on the type of inhalers used, the

patient profile, and the methods adopted.^{8,9} In addition, a gradual temporal decline in the correct technique of inhaler use has also been observed.¹⁸⁻²⁰ However, a systematic assessment to determine the deficiencies in inhaler technique has not been carried out so far. This information is essential to plan a structured educational protocol while initiating patients on MDI therapy.

Thus, we attempted to evaluate the technique of patients using manually operated MDIs, to re-evaluate after a structured educational intervention, and to assess for any evidence of temporal decline.

Material and Methods

This study had a randomised, parallel-group design with patients recruited from the Pulmonary and Sleep Medicine Outpatient Department of the All India Institute of Medical Sciences (AIIMS, New Delhi). Subjects were randomly selected from patients with respiratory disorders, aged 18 years and above, and

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Correspondence and reprint requests: Dr Anant Mohan, Additional Professor, Department of Pulmonary Medicine and Sleep Disorders, New Delhi-110 029, India; E-mail: anant_mohan@rediffmail.com and anantmohan@yahoo.com

currently using a manually operated MDI. Patients who did not self-administer their MDI or had linguistic difficulty in understanding the instructions were excluded from the study. Ethical approval was obtained from the Institutional Review Board and a written informed consent was taken from all the participants. A time period of two months was chosen as the point of re-evaluation for inhaler technique.

All the patients were evaluated separately by two investigators. Each investigator was familiar with appropriate MDI technique and also attended a 1-day training seminar on the proper use of MDIs conducted by an experienced pulmonary physician. At baseline, data was collected regarding patient demographics, history of the disease, use of respiratory medications, and previous MDI instructions. Patients were then asked to demonstrate how they self-administered their MDI, using a placebo. No oral instructions, prompts or critiques were provided by the observers prior to, during, or after this demonstration. Inhaler technique was evaluated using a standard check-list of recommended steps (National Institute of Health [NIH] guidelines) (Table)²³, with 1 point given for each step performed correctly (maximum score = 8, "correct technique"). Following baseline assessment, randomised educational intervention was provided. The patients were divided randomly into two groups, with one group receiving written instructions regarding the correct technique step-wise (written instruction group) and the other group receiving practical demonstration by the instructor on the correct steps of using a placebo MDI (practical instruction group). The patients were then asked to demonstrate how they now used MDI using the placebo MDI and were evaluated with the standard check-list. The instructions and assessment of technique were repeated until the patient demonstrated the correct technique, or for a maximum of three times in the same sitting.

The patients were followed up after two months and the technique of inhalation was re-evaluated using the same check-list. Those who failed to achieve full score were subjected to same interventions (written instruction/practical instruction) twice or till they received a full score, whichever came earlier.

MDI Instructions

The instructions were based on NIH-Expert Panel 3 guidelines for inhaler usage.²³ The written instruction consisted of a pamphlet containing the steps in their preferred language (English/Hindi) which the patients were asked to read and follow. The practical instruction comprised of actual demonstration of inhaler use performed by the instructor using a placebo MDI.

Results

A total of 134 patients were recruited for the study. Of these, 17 patients could not complete evaluated the two-month follow-up and were excluded. Thus, 117 patients were analysed. The mean (\pm SD) age of the study group was 48.1 (\pm 16.2) years, and included 81 males (69.2%). The mean (\pm SD) duration of symptoms and inhaler usage were 5.37 (\pm 5.9) years and 28.7 (\pm 39.5) months, respectively. Majority of patients (83.5%) were initiated on inhaler therapy in a tertiary centre, with 58.8% reporting as having received prior inhaler therapy instructions by their prescribing physician. Only 36.6% of patients were using a spacer device regularly, while only 30% of patients reported having read the inhaler instructions given in the insert package. Of the whole group, 59 patients were randomly allocated to the written intervention and 57 were allocated to practical intervention.

During baseline evaluation, only 1 of the 117 subjects could perform all the steps of inhaler usage correctly. This patient was, therefore, not provided the inhaler technique education. The median score achieved by the entire group was 3 (range, 1-8), which increased to 6, 7 and 8, respectively in the subsequent three interventions. At the completion of three sessions of intervention, 97.4% of subjects were able to achieve a full score. Of these, 28 patients (24.1%) achieved a full score after the first intervention itself while 44 (37.9%) and 41 (35.3%) patients reached the full score after 2 and 3 interventions, respectively.

At baseline, the commonest errors observed were "not breathing out of the mouth before inhaling" (step 3) (84.6% of patients), and "not holding breath for 10 seconds or more" (step 7) (77.8%) (Figure 1).

In the follow-up assessment conducted after two months, the overall median score dropped from 8 to 7,

Table. National Institute of Health-Expert Panel 3 guidelines for inhaler usage technique²³

| | |
|---------|--|
| Step 1: | Remove cap from the mouth-piece of canister, hold upright, with thumb below the base and finger on top of the canister |
| Step 2: | For the first use or using after more than 7 days, shake and release one puff into air |
| Step 3: | Stand or sit straight. Breathe out through the mouth |
| Step 4: | Place the mouth-piece between teeth and close lips without leaving any gap |
| Step 5: | Breathe in and release one dose with simultaneously breathing in |
| Step 6: | Remove the inhaler and close the mouth immediately |
| Step 7: | Hold breath for 10 seconds or as long as possible |
| Step 8: | Wait for at least one minute before taking the second dose |

and increased back to 8 after providing educational intervention as per protocol (Figure 2).

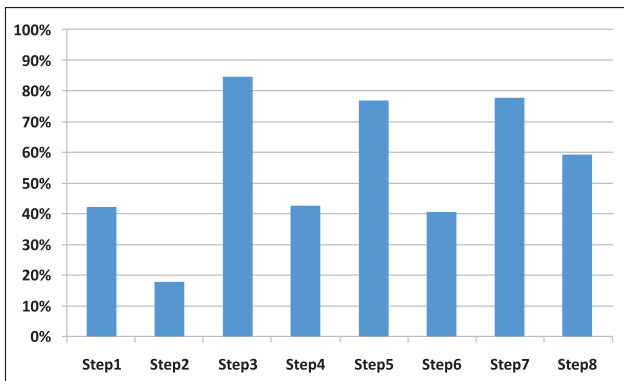


Figure 1. Proportion of patients with incorrect steps in inhaler technique at baseline evaluation, as per inhalation steps shown in the table.

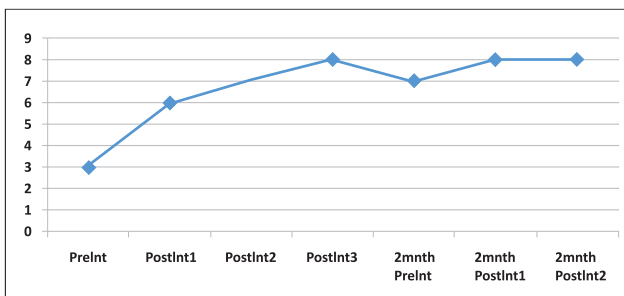


Figure 2. Median score for inhalation technique²³ after each intervention.

Preint=pre-intervention (baseline) score; Postint1=post first intervention score; Postint2=post second intervention score; Postint3=post third intervention score; 2mth Preint=preintervention score at 2 month follow up visit; 2mthPostint1=post first intervention score at 2 months; 2mthPostint2=post second intervention score at 2 months.

In order to compare the efficiency of the interventions, the improvement in score after the first intervention was compared individually for both the interventions. A significant difference was observed in the median score improvement achieved in the practical demonstration group compared with written instruction group (3.0 versus 2.0, $p < 0.001$).

Discussion

Improper inhaler usage is often the achilles heel in the management of patients with respiratory disorders. In spite of this awareness, there are, surprisingly, a lack of systematic studies evaluating the lacunae in inhaler use by the patients. We aimed to determine the extent of errors during inhaler use, as well as to assess the change after imparting appropriate education over a period of time.

We observed that majority of patients had an improper inhaler technique when checked at random. Similar results have been observed in several other studies, with upto 76% of patients committing errors in

inhaler use.⁸⁻¹³ It is a common observation that patients are not instructed regarding inhaler use at the time of initiating therapy. Even among our patients, only 58.8% had received prior education regarding use of inhaler technique, which is lower than that reported by Larsen *et al*⁸ (63%), who conducted the study in a US population with 501 subjects. This does underline the need for devoting more time to a baseline demonstration and education when inhaler is prescribed for the first time. Only 30% of patients had read or seen the inhaler instructions given in the package insert. This low percentage could be one of the major reasons for poor inhaler use technique in our patients.

In addition, the usage of a spacer device in our patient group was considerably low (36.6%). The reasons for this could be multi-factorial, including financial constraints, the bulk and inconvenience to use or carry, or lack of prescription by the physician. However, with guidelines now advocating mandatory use of spacers along with MDIs, all educational interventions regarding technique of use of inhalers should include imparting knowledge of use of spacers as well.

As baseline, virtually none of the patients achieved a perfect score on the inhaler check-list. The commonest errors were “omitting to exhale before inhaling”, and “not holding the breath for 10 seconds after inhaling”. Both these steps are important in allowing maximum inhalation and drug delivery.

We noticed a significant improvement in inhaler technique after a systematic education session. It is notable, however, that only 24% patients achieved a full score after one session of education; and it took three sessions for 97% patients to get a full score. This implies that multiple sessions and reinforcement is essential to achieve perfection in inhaler technique.

There are two common methods of patient education—one, to provide printed material/handouts containing pictures/text, and second, to impart actual physical demonstration of the technique. We compared both the methods in improving the technique of inhaler use. Our results showed that a practical demonstration is more effective than a written educational material in improving the inhaler use technique. These findings are consistent with previous studies, wherein a structured educational demonstration achieved a better result compared to provision of instruction pamphlets.^{14,15} It is possible that this difference in outcome emerged due to the fact that steps, such as breathing in deep with mouth closed (Step 5) demands higher skill development and understanding, which is better achieved when the patient actually observes the steps being demonstrated rather than simply reading them. It also suggests that greater emphasis should be laid on these specific steps during demonstration.¹⁴⁻¹⁷

We noticed a small but definite temporal decline in the scores achieved by the group when they were re-assessed after two months. This is a significant finding

which has received less attention by the clinicians and the health educators alike, and underlines the need for repeated educational reinforcement to maintain a correct inhaler use technique.

This study is not without limitations. A sample size of convenience was taken as we could not find any suitable reference to assist calculation of sample size. All patients using inhalers were recruited irrespective of the frequency and regularity of their usage. The check-list involved only a MDI and not a concomitant use of spacer device. Only MDIs were evaluated and dry powder inhalers were not included in the current study. In spite of these shortcomings, this study provides useful information regarding the errors committed by patients using MDIs and methods to correct these flaws. This may have important implications for disease management. Subsequent assessment of improvement in control of disease following correction of a faulty inhaler technique may provide more definite evidence of the practical importance of a systematic educational intervention even in busy clinics.

To conclude, there is a high prevalence of faulty usage of inhaler technique among patients. Repeated demonstration of the proper technique using a standard check-list significantly reduces the errors committed during inhaler use.

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