

EVALUATION OF THE METERED-DOSE INHALER TECHNIQUE AMONG HEALTHCARE PROVIDERS

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Abstract- Poor inhaler technique is a common problem both in asthma patients and healthcare providers, which contributes to poor asthma control. This study was performed to evaluate the adequacy of metered-dose inhaler (MDI) technique in a sample of physicians and nurses practicing in Hamadan University hospitals. A total of 173 healthcare providers voluntarily participated in this study. After the participants answered a questionnaire aimed at identifying their involvement in MDI prescribing and counseling, a trained observer assessed their MDI technique using a checklist of nine steps. Of the 173 participants, 35 (20.2%) were physicians and 138 (79.8%) were nurses. Only 12 participants (6.93%) performed all steps correctly. Physicians performed essential steps significantly better than nurses (85.7% vs. 63.8%, $P < 0.05$). The majority of healthcare providers responsible for instructing patients on the correct MDI technique were unable to perform this technique correctly, indicating the need for regular formal training programs on inhaler techniques.

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INTRODUCTION

Asthma is a major cause of chronic morbidity and mortality throughout the world and the prevalence is increasing, especially among children (1). Despite the recent advances in the understanding of its pathophysiology and the availability of effective treatments, asthma continues to be a major cause of morbidity leading to a significant economic burden to individuals and societies (2). Poor asthma control has been related to several common and important problems including under diagnosis and inadequate treatment (1), poor patient understanding of the disease and its treatment (2, 3) non-compliance (4-6), and incorrect use of inhaler devices (5,6).

Inhaled medications are the cornerstone of asthma treatment (6). However, poor patient inhaler technique has been identified as a common and persistent problem by many studies worldwide (8-12). Up to 90% of adult patients have been reported to have inadequate inhaler technique with higher rates of errors in children and old patients (7-10). Poor inhaler technique reduces the drug delivery to the airways, decreasing the efficiency of the inhaled drug (6).

The high prevalence of incorrect inhaler technique by patients has been explained by several factors (11, 12). Most healthcare providers do not spend sufficient time educating patients on the correct use of the inhalers (13). Another problem is the lack of regular periodic assessment of patients' inhaler technique, essential to ensure proper use (12-14). More importantly, studies show that most providers themselves have poor inhaler technique (15, 16). Thus, they may give incorrect instructions to patients (15). The correct use of inhalers has been

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shown to be influenced by patients' characteristics, such as their age and their understanding of asthma and its treatment (5). Therefore, the magnitude of the problem may vary in different populations.

Formal training and demonstration of the correct use of inhalers have been shown to improve the skills of inhaler use in both patients and healthcare providers (5, 17).

Local baseline information is, therefore, essential for each country to develop its own asthma care services and educational programs targeted at their specific problems and needs (1).

Asthma is common in Iran (18) and most inhaler devices including MDI and dry powder inhalers are available for its treatment. There are some published data on the ability of Iranian patients to use these inhalers correctly but similar data are not available for healthcare providers. This study, accordingly, aimed to evaluate the ability of healthcare providers in Hamadan to demonstrate the correct MDI technique.

MATERIALS AND METHODS

A total of 173 healthcare providers including 35 internists and emergency doctors as well as 138 nurses from Sina, Mobasher and Ekbatan Hospitals were voluntarily participated in this observational descriptive cross-sectional study. All of the 3 educational hospitals are dependent to the Hamadan University of Medical Sciences.

After answering a brief verbal questionnaire aimed at identifying involvement in asthma management and MDI technique counseling, each participant was asked to demonstrate the use of the MDI by taking two puffs from a placebo MDI device (Glaxo/Welcome Inc. UK). One trained observer (an internist) using a checklist of nine steps graded the correctness of each participant technique. The nine steps were based on manufacturer's instructions and international clinical guidelines on the MDI technique (19). Steps 1, 4, 5 and 6 were considered essential for proper delivery of the inhaled medications and the remaining steps were classified as recommended for optimal delivery but not essential. The acceptability of each step was defined

as follows (19): the participant must shake the canister vigorously and breathe out slowly and completely before each puff. Positioning was considered correct if the canister was held in the upright position and either inserted between closed lips or up to four centimeters in front of the open mouth. The participant must then begin a slow inhalation just before depressing the canister once (actuation). The timing of actuation (co-ordination) was considered correct if it occurred anywhere during the first third of the slow inspiration including simultaneously with the start of inhalation. The slow inspiration must continue to total lung capacity after which the inhaler is removed and the lips kept closed, with breath-holding for at least 10 seconds. Finally, the participants must wait at least 30 seconds before starting the second puff.

Data were analyzed using statistical software (EPI6). The different groups of participants were compared using the Chi square test and $P < 0.05$ was considered significant.

RESULTS

Of 173 healthcare providers 51 (29.5%) were male and 122 (70.5%) were female. The mean age of participants was 29.5 ± 6.93 years. Involvement in teaching the use of inhalers to the patients was reported by 141 (80%) participants.

The entire group consisted of two categories of healthcare providers: 35 physicians (20.2%) and 138 nurses (79.8%). The nurses were analyzed as non-physicians. The physicians group was heterogeneous, consisting of pulmonologist, nephrologists, endocrinologist, general internists and general practitioners.

Table 1 lists the nine steps of MDI technique and the percentage of healthcare providers who showed the correct technique for each step.

Except for step 2 (breathe out slowly and completely) and step 9 (wait for 20-30 seconds before starting the second puff), the frequency of correct technique was high (70.2-97.2%). The frequencies of participants who made error in only essential steps and any step were 33.3% and 92.6%, respectively.

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Table 1. The nine steps of correct metered-dose inhaler technique and the percentage of healthcare providers performing each step correctly

Step	Procedure	% correct
1*	Remove cap and shake the inhaler vigorously	97.2%
2	Breath out slowly and completely	24.4%
3	Hold the inhaler in the upright position	85.7%
4*	Insert the mouthpiece into mouth between closed lips or up to 4 centimeters in front the open mouth	88.1%
5*	Depress the canister once and...	74.4%
6*	... at the same time begin slow deep inhalation continue to total lung capacity (co-ordination)	93.2%
7	Remove the inhaler with closed lips	86.2%
8	Hold breath for 10-15 seconds	70.5%
9	Wait for 20-30 seconds before starting the second puff	21.0%

*Essential steps.

Of the essential steps, depressing the canister once (step 5) had the highest frequency of error (25.6%), while among non-essential (preferred) steps, highest frequency of errors was observed in breathing out slowly and completely and waiting for 20-30 seconds before starting the second puff (steps 2 and 9, 75.6% and 79%, respectively).

Figure 1 shows the frequency of participants' correct inhaler technique. Only 12 of 173 participants (6.93%) performed all steps correctly. When only essential steps were considered, the overall performance increased to 116 out of 173 (67%). Nurses performed significantly better than physicians (5.8% vs. 1.4%, $P < 0.05\%$). When only essential steps were considered, physicians performed significantly better than nurses (85.7% vs. 63.7%, $P < 0.05$). Males performed all steps relatively better than females (13.5% vs. 65%, $P > 0.05$).

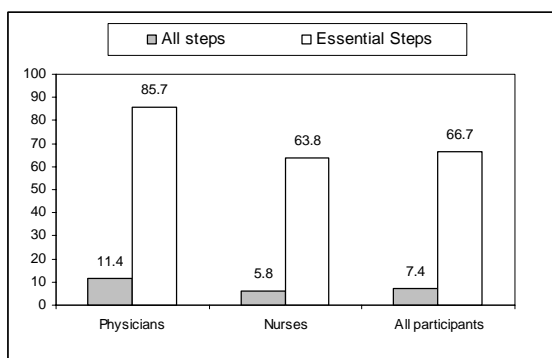


Fig. 1. Percentage of healthcare providers who performed MDI. P value (all steps) = 0.12 (non-significant); P value (essential steps) = 0.02 (significant).

DISCUSSION

The change from oral to inhaled medications as the preferred route of administration has been one of the most important developments in asthma treatment (1). Inhaler therapy is now the preferred mode of delivery of many drugs used in the treatment of asthma and chronic obstructive pulmonary disease (6, 22). It is the only way to deliver some drugs such as anticholinergics and sodium cromoglycate and is the preferred mode of delivery for β -agonists and corticosteroids. The major advantage of inhalation therapy is the direct delivery of medications in much smaller effective doses compared to systemic routes, thus reducing side-effects (22). In addition, inhaled bronchodilators act more quickly (22). The important limitation of inhaler devices is that they are more difficult to use and less convenient than tablets. Each inhaler device has its own specific sequence of steps for optimal drug delivery and it is therefore necessary to give careful and correct instruction to patients (1). MDI, the most commonly used device, requires the patient to co-ordinate inhalation with action of the device (actuation) which can be difficult for some (6, 12).

Patients with asthma have been shown to have poor inhaler technique, an important cause of poor asthma control (5, 8-10). As a result, clinical guidelines of International Asthma Management emphasizes the importance of demonstrating the correct inhaler technique at initial diagnosis and correcting patient performance at each follow-up visit (1). Unfortunately, numerous studies

consistently show that healthcare providers have poor inhaler technique (6, 16). The reported rate of correct inhaler technique among various groups of physician is in the range of 28–69% in different studies with respiratory specialist and internists performing relatively better than others (23-27). For nurses, the reported rate of correct inhaler technique is in the range of 15–66% (28). In one study, respiratory therapists performed better than physicians (28). In another study, asthmatic patients performed better than both physicians and nurses (29). However, this universal problem has been shown to improve by formal and regular training of both patients and healthcare providers (30-34).

Asthma is common in Iran (18). The present study is part of a comprehensive project evaluating the different aspects of asthma in this country to design a national program for the management of asthma. The results of this study show that poor MDI technique was very common in this sample of healthcare providers. Despite involvement of all participants in patients counseling on inhalers, only 6.93% of them were able to perform all steps correctly, which was substantially lower than reports from the literature.

Frequencies of errors were higher for non-essential (preferable) than essential steps. Of the essential steps, the greatest number of errors occurred in steps 5 (depress the canister once), whereas inadequate breath out and waiting before a second puff (steps 2 and 9) were the non-essential steps with highest frequency of error. Although physicians performed essential steps relatively better than nurses (85.7% had correct technique), their performance was still unacceptably low for all steps.

Because of their position, nurses also have opportunity to educate patients on inhaler use. It is therefore essential that all providers master the correct technique. Training programs involving instructions and demonstration of the inhaler technique have been shown to improve the skills of patients and providers (17, 30-34). The very poor inhaler technique observed in our study is most probably due to the lack of any formal training for healthcare providers on the correct use of inhalers.

In conclusion, healthcare providers' skill in the MDI technique in Hamadan is very limited,

indicating the need for establishing regular educational programs for both patients and providers. In addition, our results indicate that inhaler technique training programs for healthcare providers must include not only the physicians but also nurses. Special attention should be paid to correct the errors in the non-essential steps of inhaler technique.

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