ASSESSMENT OF METERED DOSE INHALER TECHNIQUE IN COPD PATIENTS IN TERTIARY CARE HOSPITAL

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ABSTRACT

Objective: To determine the frequency of incorrect Metered Dose Inhaler (MDI) technique and common factors leading to it among patients with chronic obstructive lung disease (COLD).

Materials and methods: This study was conducted in the in the Department of Medicine, Lady Reading Hospital, Peshawar from 1st July 2012 to 30th June 2013. Through a Descriptive Cross Sectional Study Design, a total of 201 patients of COPD fulfilling the inclusion criteria were selected in a consecutive manner and were observed for the method of MDI Technique keeping British thoracic society devised MDI technique as standard.

RESULTS: Male patients (72.1%) outnumbered female (27.9%) patients. Mean age of the group 47.37 with 13.2 SD. Of all patients, incorrect MDI technique was observed in only 70.1% of patients with actuating the device and inhaling slowly being the most commonly performed incorrectly in 60% of patients. The common factors leading to incorrect technique were 85.8% of patients not received MDI instruction properly and 56% had education status less than primary schooling.

CONCLUSION: Metered dose inhaler technique is incorrect in majority of COPD patients. Lack of prior technique education and educational status of patient are leading factors for substandard technique.

KEY WORDS: COLD, Metered Dose Inhaler, Technique

INTRODUCTION

Inhaled medications have become a cornerstone of asthma and COLD therapy but the effectiveness of such therapy can be compromised if the patient uses the metered dose inhaler incorrectly. The magnitude of this problem has been well documented. In one study in hospital setting percentage of steps completed correctly by the study participants (trained hospital staff) ranged from 34.9% (with 65.1% patients having incorrect method) with the dry powder inhaler (DPIs) to 67.6% (with 32.4% patients having incorrect method) with the metered dose inhaler[1]. However, published studies from around the world suggest that as many as 25% of patients with asthma or COLD have never received verbal inhaler technique instruction. When given, instruction is often rushed, poor quality and not reinforced[2].

Lower education levels have been associated with an increased rate of incorrect technique and were observed in 33% of patients on MDI.[3] some older patients with advanced COLD may benefit from the use of a spacer with a pMDI[4]. Poor inhaler technique might be more common among patients with poor English language skills, due to difficulties understanding the instructions[5].

A high proportion (31–85%) of health professionals shows incorrect technique when tested objectively, and these rates are similar between doctors, nurses and community pharmacists[6].

Even with experienced inhaler users, don't rely on patients' judgment of their inhaler technique. In an Australian study, 75% patients using an inhaler for an average of 2–3 years reported they were using their inhaler correctly but, on objective checking, only 10% demonstrated correct technique and 90% with incorrect MDI technique. Most patients will have received instruction only at the time of their first prescription[6]. The problems encountered in their use and effective delivery of drug are up to 80 percent of drug's deposition in the oropharynx and actuation-inhalation in-coordination. These can be remedied by the use of spacer device which holds the medicine in a chamber long enough for the patient to inhale slowly and deeply and use of devices activated by the patient's breath which eliminate the need for coordination and deliver the medications more effectively; training aids can also be utilized[7].

Spacers, breath actuated devices and training aids are not readily available and their use incurs additional financial burden. So the teaching of correct inhaler technique remains the best available option to ensure effective delivery of medication leading to better airway response. However, health professionals may themselves be lacking in the proper technique for teaching the use of metered dose inhalers. A study carried out in Pakistan showed that only 25 % doctors knew the correct method (while 75% did not know the correct method)[8]. This may translate to a very limited knowledge of MDI technique at patient level. This needs to be assessed[9] as without correct technique metered

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dose inhalers will fail to give projected effectiveness.

Chronic airway diseases are quite common in our population and the use of MDI is quite often prescribed and route of choice for the administration of drugs directly to the airway. The current study will provide us with local statistics regarding the incorrect technique of MDI in our local population with Asthma and COLD and also about common factors which led to the incorrect technique. This study will be first of its kind in our local populations and the results of this study can provide us grounds for further recommendations for self audit of health professionals in instructing the patients with COLD and Asthma regarding use of metered dose inhalers and also devising a system for explaining the procedure of MDI to patients with low literacy level.

The inhalation of therapeutic aerosols is an effective method of drug delivery frequently applied to the management of respiratory diseases. Inhaled medications have become a cornerstone of asthma therapy but the effectiveness of such therapy can be compromised if the patient uses the metered dose inhaler (MDI) incorrectly. The magnitude of this problem has been well documented. In one study in hospital setting percentage of steps completed correctly by the study participants (trained hospital staff) ranged from 34.9% with the dry powder inhaler to 67.6% with the metered dose inhaler[10]. Furthermore, it has been shown that correct technique delivers the medication more effectively and leads to better airway response. Incorrect technique has been shown to be related to more adverse events in COLD patients[11].

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OBJECTIVE

To determine the frequency of incorrect Metered Dose Inhaler technique and common factors leading to it among patients with chronic airway diseases.

MATERIALS AND METHODS

This study was conducted in the in the Department of Medicine, Lady Reading Hospital, Peshawar from 1st July 2012 to 30th June 2013. Through a Descriptive Cross Sectional Study Design, a total of 201 patients of COLD fulfilling the inclusion criteria were selected in a consecutive manner and were observed for the method of MDI Technique keeping British thoracic society devised MDI technique as standard.

OPERATIONAL DEFINITIONS

Incorrect MDI Technique

It defined as "A patient unable to perform at least one step correctly or can even complete all of the following nine steps but not in descending order" mentioned below.

Shake vigorously for at least 10 seconds before uncapping the device. Hold the MDI in a vertical position, with the outlet aimed at the mouth. Place the canister outlet between lips and breathe out normally. Breathe in slowly; actuate the MDI at beginning of inspiration and continue to inhale after the actuation of MDI. Hold breath for 4 to 10 second. Wait at least 15 seconds between actuations.

Inclusion criteria: Individuals aged more than 16 years, of both genders. Individuals who have been using metered dose inhalers for more than 06 months COLD.

Exclusion criteria: Occasional use of metered dose inhalers. Patients with history of psychiatric problems.

DATA COLLECTION PROCEDURE

The study was conducted after approval from the hospitals ethical and research committee. All patients presenting with COLD have been prescribed/using MDI for at least 6 months were included in the study through OPD. The purpose and benefits of the study will be explained to all patients and a written informed consent was obtained.

All patients were carefully assessed in a private chamber and in the presence of a expert physician minimum of five years of experience regarding steps of MDI and were labeled as incorrect if he/she fails to perform the steps in descending order or if he/she missed at least one step of the procedure (see operational definitions). Among those patients in whom the incorrect MDI technique was detected, further scrutinized for common factors leading to incorrect technique i.e. instructions not received for MDI technique and lower education status.

All the above mentioned information including name, age, gender and other relevant information was recorded in a pre designed Performa. Strictly exclusion

criteria were followed to control confounders and bias in the study results.

DATA ANALYSIS PROCEDURE

Data was analyzed using SPSS version 10. Descriptive statistics were used to calculate Mean and SD for age and duration of illness. Frequencies and percentages are presented for categorical variables like gender, incorrect MDI technique and common factors leading to it (instructions not received for MDI technique and lower education status). Improper MDI technique and common factors leading to it are stratified among age, gender and duration of illness to see the effect modifications. All results are presented in the form of tables and graphs.

RESULTS

In this study a total of 201 patients of COLD using metered dose inhalers for more than six months were studied presenting in the out patients department.

While distributing the sample with regards to gender, out of 201 patients 145 (72.1%) were male and 56 (27.9%) were female patients. (Figure 1)

The mean age of the sample was 47.37 (16 and above). Median age was 46 years with a standard deviation of 13.2. While distributing the sample in different age groups, we found that in the age group 12-25 years there were only 27 (13.4%), in the age group >25-38 years there were 49 (24.4%), in the age group >38-51 years there were 70 (34.8%) while in the age group >51 years and above there were 55 (27.4%) patients.(Table 1)

All the patients were taken in an ideal environment and were asked to perform the MDI procedure as they usually do at their homes. On the basis of steps of MDI mentioned in operational definitions, correct MDI technique was correctly completed by only 60 (29.9%) patients and at least one step was improperly performed by 141 (70.1%) of patients representing incorrect MDI technique. (Table 2)

While looking into frequencies of individual steps being improperly performed, Shake the MDI before uncapping the device (step 1) was incorrectly performed by 20 (9.9%) of patients**.** (Table 3)

Holding the MDI upright (step 2) was incorrectly performed by 5 (2.5%) of patients. (Table 4)

Breath out slowly and fully (step 3) was incorrectly performed by 50 (24.9%) of patients. (Table 5)

Breathe in slowly; actuate the MDI at beginning of inspiration and continue to inhale after the actuation of MDI (step 4) was incorrectly performed by 35 (17.4%) of patients. **(Table 6)**

Actuating the device (press the canister) & inhale slowly to total lung capacity and Holding the breath for

Table No. 1: Age Wise Distribution of the Sample

AGE (YEARS)	NO OF CASES	PERCENTAGE
12-25	27	13.4%
>25-38	49	24.4%
>38-51	70	34.8%
>51+	54	27.4%
Total	201	100%

Table No: 2 Frequency of Incorrect MDI Technique

IN-CORRECT MDI TECH-NIQUE	NO OF PA-TIENTS	PERCENTAGE
No	60	29.9%
Yes	141	70.1%
Total	201	100%

Table No: 3. Removing the Cap and Shake Before Use

	FREQUENCY	PERCENT
Correct	181	90.1
Incorrect	20	9.9
Total	201	100

Table No: 4. Holding the MDI Upright

	FREQUENCY	PERCENT
Correct	196	97.5
Incorrect	5	2.5
Total	200	100

Table No: 5. Breathe Out Slowly and Fully

	FREQUENCY	PERCENT
Correct	151	75.1
Incorrect	50	24.9
Total	201	100

Table No: 6. Breathe In Slowly; Actuate the MDI at Beginning of Inspiration and Continue to Inhale after the Actuation of MDI

	FREQUENCY	PERCENT
Correct	166	82.6
Incorrect	35	17.4
TOTAL	201	100

Table No: 7. Actuating The Device (Press The Canister) & Inhale Slowly To Total Lung Capacity And Holding The Breath For Up To 10 Seconds After Maximal Inhalation.

	FREQUENCY	PERCENT
Correct	81	40.3
Incorrect	120	59.7
TOTAL	201	100

Table No: 8. Waiting For 15 Seconds before Next Actuation

	FREQUENCY	PERCENT
Correct	147	73.1
Incorrect	54	26.9
TOTAL	201	100

Table No: 9. Gender Wise Distribution of Incorrect MDI Technique

GENDER	TOTAL NO OF PATIENTS	IN-CORRECT MDI TECHNIQUE
Male	145	97 (67%)
Female	56	44 (78.6%)
TOTAL	201	141 (70.1%)

Table No. 10: Common Factors Leading To Incorrect MDI Technique

RISK FACTOR	NO. OF CASES	PERCENTAGE
Instruction Not Received	121	85.8%
Lower Education Status	79	56%

up to 10 seconds after maximal inhalation (step 5) was incorrectly performed by 120 (59.7%) of patients. **(Table 7)** and finally Waiting for 15 seconds before next Actuation (step 6) was incorrectly performed by 54 (26.9%) of patients. **(Table 8)**

While distributing the incorrect MDI technique with regards to gender, we found that most of the incorrect performance of MDI techniques was shown by female gender and male gender lied very low in the incorrect performance of MDI technique. Out of total 145 males 97 (67%) performed the MDI technique incorrectly while out of 56 females 44 (78.6%) performed the MDI technique incorrectly. **(Table 9)**

As we looked for the common factors leading to incorrect MDI technique, we found that out of 141 patients exhibiting incorrect MDI technique, 121 (85.8%) had not received proper instruction for all 6 steps of MDI and 79 (56%) had their education status lower than primary schooling. **(Table 10)** So it means 59 patients had mixed condition i.e. both not received instruction plus having lower education status.

DISCUSSION

The management of asthma/chronic obstructive pulmonary diseases has undergone revolutionary changes during the last few decades. To streamline their management over forty guidelines, statements and position papers have been developed in different countries. Guidelines for asthma management at primary and secondary health care levels in the sub-continent have also been published recently.[15, 16] all these guidelines are similar in broad outlines. Despite all this, the morbidity and mortality due to these illnesses is increasing worldwide. The problem with the delivery of care is considered to be one of the important factors responsible for this paradoxical situation. Patient education, pulmonary function monitoring, environmental control and pharmacotherapy are four main pillars of management.[17] Global initiative for asthma (GINA) guidelines has also divided asthma management into six inter-related parts, of which patient education is clearly an essential component .[18]

Because of excellent medical facilities, socio-economic advantages, nearly 100% literacy and other factors, asthma management in the west is intimately associated with patient education. However, despite all these advantages, even the developed countries have not been able to achieve uniform success in the implementation of their guidelines. The large "Asthma in America" survey has also highlighted these observations.[19]

It was found that inpatient and discharge-related gaps in care were common and that inpatient gaps were significantly associated with inpatient adverse events. It was also detected that a dose-response relation between inpatient gaps and inpatient adverse events. Finally, it was found that patients with inpatient adverse events had a significantly longer stay in hospital. They also found a high frequency of gaps in discharge-related care, but did not find an association between these gaps and adverse events within 30 days after discharge. The most frequent gap in the care of patients was related to assessment of the patient's technique in using a metered-dose inhaler within 24 hours after the drug order: 78% of the 89 patients for whom a metered-dose inhaler was prescribed had no documented assessment of their technique. This was in turn related to more frequent adverse events.[20]

In a recent study it was found that an average of 40%–60% of patients with COLD adheres to the prescribed regimen and only 1 out of 10 patients with a metered dose inhaler performs all essential steps correctly. [21]

National and international studies have been performed in which the assessment has been done about doctors/nurses knowledge of inhaler techniques. In a recent assessment of technique of doctors about the use of Metered Dose Inhaler (MDI) in bronchial Asthma & COLD, a total of 100 doctors' ninety males and ten females took part in this study. All adequate technique questions were answered correctly by only 25% of doctors. The most common error was not continuing slow and deep inhalation with activation of canister. It was answered correctly by twenty five doctors. The question answered best was to keep the MDI mouthpiece between the lips prior to inspiration. It was answered correctly by eighty doctors. The prevalence of incorrect technique is high and is unacceptable.[22]

If we compare our study, then they mutually support each other in that the highest percentage of errors was in the actuation-inhalation phase and continuing to inhale after actuation. The difference comes in the persons performing the technique correctly with 25% in doctors/nurses and 30% in patients. In another recent study of hospice nurses inhaler technique 67.6% participants performed correctly with MDIs which correlates favorably with our study in showing that there is an insufficient knowledge of correct inhaler technique.[23]

In a study in Oman 150 participants, 148 (99%) were involved in teaching inhaler techniques to patients, and 103 of 107 physicians (96%) had prescribed inhaled medications were assessed. However, only 22 participants (15%) performed all steps correctly. Physicians performed significantly better than non-physicians (20% vs. 2%, $p < 0.05$). Among the physicians, internists performed better (26%) than general practitioners (5%) and accident and emergency doctors (9%).

In another study, the metered-dose inhaler (MDI) techniques of 125 asthma patients who presented to a county hospital emergency department (ED) were evaluated. Correct technique was divided into 7 steps. Twenty-one percent of the patients performed all 7 steps correctly. Than Verbal individualized instruction was used to improve the technique of patients whose technique was less than perfect. All patients were able to perform all steps correctly after instruction. This explains that education in proper use of the MDI is important in the overall care of the asthma patient.[24] This evidence is further supported in another study.[25]

Results of a study more comparable to our study were observed in the study by Beerendonk et al[26] in which Two hundred eighty-one patients (88.9%) made at least one mistake in the MDI inhalation technique. The mistakes were classified into skill and nonskill mistakes. Two hundred patients made one or more skill mistakes and 81 patients only made one or more nonskill mistakes. The most common skill error was "not continuing to inhale slowly after activation of the canister" (69.6%). The nonskill item most patients had difficulties with was "exhale before the inhalation" (65.8%). Patients who used an MDI made significantly fewer nonskill mistakes than patients using a dry powder device. Older patients had more difficulty with the correct use of the inhaler than younger patients. There was no difference in errors between men and women. In this patient sample, most patients failed to use their inhaler correctly. Regular instructions and checkups of inhalation technique are the responsibility of the physician and should be a standard and routine procedure. Another study reported that 82% of patients reported with at least one step of incorrect MDI technique.[27]

CONCLUSION

Metered dose inhaler technique is incorrect in majority of COLD patients. Lack of prior technique education and educational status of patient are leading factors for substandard technique.

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