

Analysis of metered dose Inhaler technique errors in patients with obstructive airway diseases

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Date Received: Nov. 20, 2017
Date Revised: Feb. 11, 2018
Date Accepted: April 04, 2018

Author Contributions

ZUH AB AJ conceived idea, ZUH AB drafted the study, ZUH MA JK collected data, ZUH AB AJ MYK did satisfied analysis & interpretation of data, ZUH AB AJ critical reviewed manuscript, All Approved final version to be published

Declaration of conflicting interests

The Authors declares that there is no conflict of interest.

ABSTRACT

Background: Obstructive lung disease is a category of respiratory disease characterized by airway obstruction. It is generally characterized by inflamed and easily collapsible airways, obstruction to airflow, problems exhaling and frequent medical clinic visits and hospitalizations. Types of obstructive lung disease include; asthma, bronchiectasis, bronchitis and chronic obstructive pulmonary disease (COPD). The global prevalence of physiologically defined COPD in adults aged >40 yr is approximately 9-10%.

Objective: Objective of the present study was to determine the frequency of metered dose inhaler technique errors in patients presenting with obstructive airway disease.

Materials And Methods: This was a cross sectional study conducted at department of Pulmonology, Lady Reading Hospital Peshawar from April 2016 to August 2016. Sample size was 170 cases using 19.8% proportion of inhaler technique error, 95% confidence level & 6% margin of error. More over non-probability consecutive sampling technique was used for sample collection.

Results: Our study shows that mean age was 48 years with SD± 7.42. Fifty seven percent patients were male and 43% patients were female. Eighty three percent patients had inhaler technique error while (17%) patients didn't had inhaler technique errors.

Conclusion: Our study concludes that the incidence of metered dose inhaler technique errors was found to be 83% in patients presenting with obstructive airway disease in our setup.

Key Words: Metered dose; Inhaler technique errors; Obstructive airway disease.

This article may be cited as: Haq ZU, Basit A, Iqbal Z, Khan J, Ullah R, Amin M, Ullah Z, Khan MY, Javaid A. Analysis of metered dose Inhaler technique errors in patients with obstructive airway diseases. Pak J Chest Med 2018; 24 (2):64-71.

Introduction

Obstructive lung disease is a category of respiratory disease characterized by airway obstruction. It is generally characterized by inflamed and easily collapsible airways, obstruction to airflow, problems exhaling and frequent medical clinic visits and hospitalizations. Types of obstructive

lung disease include; asthma, bronchiectasis, bronchitis and chronic obstructive pulmonary disease (COPD).^{1,2} The global prevalence of physiologically defined chronic obstructive pulmonary disease (COPD) in adults aged >40 yr is approximately 9-10%.³

Asthma and chronic obstructive pulmonary disease are both common conditions with an increasing

prevalence worldwide. Inhaled therapy for these conditions has a number of advantages over systemic therapy, including reduced side effects and quicker onset of action. The effective use of inhaled therapy is critically dependent upon the nature of the drug-delivery system and the ability of the patient to use the system correctly.⁴

Poor inhaler technique results in less than optimal delivery of medicine to the lungs and consequent inadequate symptom control.⁵ There are a wide number of inhaler devices on the market, each with positive and negative aspects. There are a number of interventions that can help with the choice of inhaler device and also improve the ability of the patient to use inhaled therapy. Inhaler technique training needs to be a cornerstone of the care of patients with asthma or chronic obstructive pulmonary disease to ensure optimal therapy.⁴

Rationale of this study is to determine the frequency of metered dose inhaler technique errors in patients with obstructive airway diseases. In routine it has been noticed that many patients do not know how to use inhaler properly. But this may be due to lack of proper training. The prevalence of inhaler technique error is uniform and is not known in local and international studies available in literature. So through this study we want to confirm proper magnitude, so that we can plan training program for patients of obstructive diseases to use inhaler properly and reduce inhaler technique errors for effective treatment.

Objective

Object of the present study was to determine the frequency of metered dose inhaler technique errors in patients with obstructive airway diseases.

Operational Definition:

Obstructive airway disease: It is defined as inflamed and easily collapsible airways, obstruction to airflow, problems exhaling including asthma, COPD, bronchiectasis, bronchitis on clinical examination and medical record.

Inhaler technique error: It was measured if patient will do any of these steps incorrectly i.e. Remove cap, shake well, breathe out normally, and keep head upright or slightly tilted, Seal lips around mouthpiece, inhale slowly, actuating once during first half of inhalation, Continue slow and deep inhalation; hold breath for 5 or more seconds on clinical examination.

Materials And Methods

This was a cross sectional study conducted at department of Pulmonology, Lady Reading Hospital Peshawar from April 2016 to August 2016.

Sample Size: Sample size was 170 cases using 19.8% proportion of inhaler technique error, 95% confidence level & 6% margin of error.

Sampling Technique: Non-probability, consecutive sampling.

Inclusion Criteria:

Patients of age between 30 to 80 years of either gender presenting with obstructive airway disease (as per operational definition).

Exclusion Criteria:

- ? Patients with diagnosis of dementia or memory loss problem
- ? Patients with acute delirium or psychosis (on clinical examination)
- ? Patients with decreased or altered level of consciousness (on clinical examination)
- ? Patients with acute musculoskeletal injury impairing ability to use an inhaler (on clinical examination)

Data Collection Procedure:

One hundred and seventy (170) patients fulfilling inclusion and exclusion criteria were enrolled from Department of Pulmonology, Lady Reading Hospital, Peshawar. Informed consent was obtained and demographic detail (name, age, gender, type of obstructive disease) was noted. Then patients were assessed for inhalation steps, namely Remove cap, shake Well, breathe out normally, keep head upright or slightly tilted, seal lips around Mouthpiece, inhale slowly, actuating once during first half of inhalation, continue slow and Deep inhalation, hold breath for five or more seconds. With a view, that each of these steps is Crucial for effective delivery of the drug to the lung and also for instant onset of action. If patient was any step improperly, the inhaler technique error was labeled (as per operational definition). All this information was recorded on specially designed proforma.

Data Analysis:

All data was entered and analyzed in SPSS version 20.0. The quantitative variables i.e. age and duration of obstruction was presented in the form of mean $\pm$

standard deviation. The qualitative variable i.e., gender, type of obstructive disease, training received and inhaler technique error was presented in the form of frequency and percentage. Data was stratified for age (30-50, 51-70, >70 years), gender (male and female), type of obstructive disease, training received and type of obstructive disease. Chi-square was applied to compare stratified groups. P-value ≤ 0.05 was taken as significant.

Results

This study was conducted at Pulmonology Department, Lady Reading Hospital Peshawar in which a total of 170 patients were observed to determine the frequency of metered dose inhaler technique errors in patients presenting with obstructive airway disease and the results were analyzed as;

Age distribution among 170 patients was analyzed as 70 (41%) patients were in age range 30-50 years, 66

(39%) patients were in age range 51-70 years and 34 (20%) patients were in age range > 70 years. Mean age was 48 years with SD ± 7.42 . Gender distribution among 170 patients was analyzed as 97 (57%) patients were male and 73 (43%) patients were female. Type of obstructive airway disease among 170 patients was analyzed as 102 (60%) patients had asthma, 17 (10%) patients had Bronchiectasis, while 51 (30%) patients had COPD. Duration of obstructive airway disease among 170 patients was analyzed as 17 (10%) patients had obstructive airway disease from < 5 years, 46 (27%) patients had obstructive airway disease from 6-10 years and 107 (63%) patients had obstructive airway disease from > 10 years. Mean duration was 18 years with SD ± 6.63 . Inhaler technique training received among 170 patients was analyzed as 105 (62%) patients had received the training of inhaler technique while 65 (38%) patients didn't receive the training of inhaler technique (Table 1).

Table 1: Baseline demographic and disease characteristics of the study cases (n=170)

Characteristics		Frequency	Percentage (%)
Age (years)	30-50	70	41.0
	51-70	66	39.0
	>70	34	20.0
Gender	Male	97	57.0
	Female	73	43.0
Types of Obstructive Airway disease	Asthma	102	60.0
	Bronchiectasis	17	10.0
	COPD	51	30.0
Duration of illness (years)	<5	17	10.0
	6-10	46	27.0
	>10	107	63.0
Training received	Yes	105	62.0
	No	65	38.0

Table No 2: Over All Inhaler Technique Errors (n=170)

Inhaler Technique Errors	Frequency	Percentage
Yes	141	83%
No	29	17%
Total	170	100%

Table No 3: Inhaler Technique Errors (n=141)

Inhaler Technique Errors	Frequency	Percentage
Shake well	3	2%
Breathe out normally	4	3%
Keep head upright or slightly tilted	18	13%
Seal lips around mouthpiece	21	15%
Inhale slowly, actuating once during first half of inhalation	31	22%
Continue slow and deep inhalation	38	27%
Hold breath for 5 or more seconds	26	18%
Total	141	83%

Table 4: Finding of inhaler technique errors with different characteristics

Characteristics		Inhaler Technique errors		P-Value
		Yes	No	
Gender	Male	80	17	0.8159
	Female	61	12	
Age distribution (years)	31-50	58	12	0.9921
	51-70	55	11	
	>70	28	6	
Types of obstructive airways diseases	Asthma	85	17	0.9862
	Bronchiectasis	14	3	
	COPD	42	9	
Duration of Illness	<5 years	14	3	0.9940
	6-10 years	38	8	
	>10 years	89	18	
Training received	Yes	76	29	0.0000
	No	65	0	

Table No 5: Inhaler technique errors with respect to age distribution (n=141)

Inhaler Technique Errors	31-50 years	51-70 years	>70 years	Total	P value
Shake well	0	1	2	3	0.0969
	58	54	26	138	
Total	58	55	28	141	
Breath out normally	0	2	2	4	0.1568
	58	53	26	137	
Total	58	55	28	141	
Keep head upright or slightly tilted	4	7	7	18	0.0621
	54	48	21	123	
Total	58	55	28	141	
Seal lips around mouth place	4	8	9	21	0.0086
	54	47	19	120	
Total	58	55	28	141	
Inhale slowly, actuating once during first half of inhalation	6	11	14	31	0.0001
	52	44	14	110	
Total	58	55	28	141	
Continue slow and deep inhalation	7	15	16	38	0.0000
	51	40	12	103	
Total	58	55	28	141	
Hold breath for 5 or more seconds	5	10	11	26	0.0027
	53	45	17	115	
Total	58	55	28	141	

Table No 6: Inhaler technique errors with respect to gender distribution (n=141)

Inhaler Technique Errors	Male	Female	Total	P value
Shake well	1	2	3	0.4082
	79	59	138	
Total	80	61	141	
Breath out normally	2	2	4	0.7826
	78	59	137	
Total	80	61	141	
Keep head upright or slightly tilted	10	8	18	0.9136
	70	53	123	
Total	80	61	141	
Seal lips around mouth place	12	9	21	0.9675
	68	52	120	
Total	80	61	141	
Inhale slowly, actuating once during first half of inhalation	18	13	31	0.8659
	62	48	110	
Total	80	61	141	
Continue slow and deep inhalation	22	16	38	0.8662
	58	45	103	
Total	80	61	141	
Hold breath for 5 or more seconds	15	11	26	0.9133
	65	50	115	
Total	80	61	141	

Table No 7: Inhaler technique errors with respect to type (n=141)

Inhaler Technique Errors	Asthma	Bronchiectasis	COPD	Total	P value
Shake well	1	1	1	3	0.3546
	84	13	41	138	
Total	85	14	42	141	
Breath out normally	2	0	2	4	0.5928
	83	14	40	137	
Total	85	14	42	141	
Keep head upright or slightly tilted	7	4	7	18	0.0713
	78	10	35	123	
Total	85	14	42	141	
Seal lips around mouth place	9	4	8	21	0.1436
	76	10	34	120	
Total	85	14	42	141	
Inhale slowly, actuating once during first half of inhalation	19	3	9	31	0.9916
	66	11	33	110	
Total	85	14	42	141	
Continue slow and deep inhalation	23	4	11	38	0.9843
	62	10	31	103	
Total	85	14	42	141	
Hold breath for 5 or more seconds	16	3	7	26	0.9142
	69	11	35	115	
Total	85	14	42	141	

Table No 8: Inhaler technique errors with respect to duration (n = 141)

Inhaler Technique Errors	<5 Years	6-10 years	> 10 years	Total	P value
Shake well	1	1	1	3	0.3382
	13	37	88	138	
Total	14	38	89	141	
Breath out normally	0	1	3	4	0.7762
	14	37	86	137	
Total	14	38	89	141	
Keep head upright or slightly tilted	0	8	10	18	0.1013
	14	30	79	123	
Total	14	38	89	141	
Seal lips around mouth place	2	6	13	21	0.9831
	12	32	76	120	
Total	14	38	89	141	
Inhale slowly, actuating once during first half of inhalation	3	8	20	31	0.9831
	11	30	69	110	
Total	14	38	89	141	
Continue slow and deep inhalation	4	10	24	38	0.9868
	10	28	65	103	
Total	14	38	89	141	
Hold breath for 5 or more seconds	3	7	16	26	0.9532
	11	31	73	115	
Total	14	38	89	141	

Inhaler technique errors among 170 patients was analyzed as 141(83%) patients had inhaler technique error while 29 (17%) patients didn't had inhaler technique errors (Table 2).

Stratification of inhaler technique errors with respect to age, gender, obstructive airway disease, type obstructive airway disease and Inhaler technique training received is given in table 3.

Discussion

Obstructive lung disease is a category of respiratory disease characterized by airway obstruction. It is generally characterized by inflamed and easily collapsible airways, obstruction to airflow, problems exhaling and frequent medical clinic visits and hospitalizations. Types of obstructive lung disease include; asthma, bronchiectasis, bronchitis and chronic obstructive pulmonary disease (COPD).^{1,2} The global prevalence of physiologically defined chronic obstructive pulmonary disease (COPD) in adults aged 40 year is approximately 9-10%.³

Our study shows that among 170 patients (41%) patients were in age range 30-50 years, (39%) patients were in age range 51-70 years and (20%) patients

were in age range > 70 years. Mean age was 48 years with SD± 7.42. Fifty seven percent patients were male and 43% patients were female. Sixty percent patients had asthma, (10%) patients had Bronchiectasis, while (30%) patients had COPD. Ten percent patients had obstructive airway disease from < 5 years, (27%) patients had obstructive airway disease from 6-10 years and (10%) patients had obstructive airway disease from > 10 years. Mean duration was 18 years with SD± 6.63. Sixty two percent patients had received the training of inhaler technique while 38% patients didn't received the training of inhaler technique. Eighty three percent patients had inhaler technique error while 17% patients didn't had inhaler technique errors.

One study has reported that 59%⁶ of patients made one or more critical errors, a greater percentage than in previous studies, for which rates were between 19.8% and 40.1%.⁷⁻⁹ The inhaler-specific error rates were as follows: Aerolizer 9.1%, Discus 26.7%, Handi Haler 53.1% and Turbuhaler 34.9%.¹⁰ One study conducted in Pakistan, reported that inhaler technique error was observed in 24% patients only.¹¹ While another study has reported that there were 61.53%

patients who had inhaler technique error.¹²

Similar results were found in another study conducted by de Oliveira PD et al¹³ in which a total of 110 subjects were included, who collectively used 94 MDIs and 49 DPIs. The most common errors in the use of MDIs and DPIs were not exhaling prior to inhalation (66% and 47%, respectively), not performing a breath-hold after inhalation (29% and 25%), and not shaking the MDI prior to use (21%). Individuals ≥ 60 years of age more often made such errors. Among the demonstrations of the use of MDIs and DPIs, at least one error was made in 72% and 51%, respectively. Overall, there were errors made in all steps in 11% of the demonstrations, whereas there were no errors made in 13%. Among the individuals who made at least one error, the proportion of those with a low level of education was significantly greater than was that of those with a higher level of education, for MDIs (85% vs. 60%; $p = 0.018$) and for DPIs (81% vs. 35%; $p = 0.010$).

The proportion of occurrence of any inhaler technique error, as per the checklist, relative to the number of inhalers tested was smaller than expected given previous findings in the literature: in one study, although patients reported knowing the proper inhaler technique, approximately 90% made some error.¹⁴ In addition, in a telephone survey, 77 of 87 respondents reported that their technique had never been checked by a health care professional, and, of 26 patients selected for a demonstration, none achieved satisfactory performance.¹⁵ In contrast, a study conducted in the state of Bahia, Brazil, reported that more than half of the individuals studied showed good inhaler technique for all inhaler models; however, the sample consisted of individuals who received follow-up and underwent inhaler technique assessment periodically, and the criterion for classification of patient performance of the technique as good was 75% of steps correctly completed or more.¹⁶

The characteristics of patients requiring inhaler use also deserve significant attention at the time of prescription. Previous studies have reported that elderly patients make more errors because they have cognitive changes, among other factors.^{17,18} In our study, the proportion of errors was greater among patients in the 60-or-older age group; however, we could not detect a significant difference in their inhaler technique relative to that of patients in the younger age groups. The 60 or older age group was the smallest in our sample, and this was possibly the factor that prevented the detection of significant differences relative to the technique used by younger

patients. One explanation for the low number of participants in this advanced age group would be the lower number of MDI users, even though this group has a significant number of subjects who report having respiratory diseases.¹⁹ Many may not have adapted to this type of inhaler and prefer to use nebulization, which is indicated for those who are too cognitively impaired to use other inhaled drug delivery systems; in addition, one exclusion criterion of the present study was requiring assistance from others to use the inhaler or using the MDI with a spacer and a mask, resources often used in this age group. According to a previous study, 20 nebulizer users are of advanced age, have respiratory conditions that are more severe, and have great difficulty in using MDIs.

Conclusion

Our study concludes that the incidence of metered dose inhaler technique errors was found to be 83% in patients presenting with obstructive airway disease in our setup.

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