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THE CORRECT INHALATION TECHNIQUE AMONG PATIENTS TREATED FOR ASTHMA AND CHRONIC OBSTRUCTIVE PULMONARY DISEASE IN EASTERN SAUDI ARABIA

General Medicine

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ABSTRACT

Proper use of inhaler devices is an essential determinant of asthma or chronic obstructive pulmonary disease (COPD) control and life quality. This cross-sectional study was conducted between October 2017 to January 2018, to evaluate the inhalation technique of asthmatic or COPD patients attending the pulmonary clinic, at King Abdulaziz Hospital in Al Ahsa city. The data was collected using a structured questionnaire to determine the prevalence of proper using of inhalation techniques and to investigate patients' characteristics and factors associated with improper use of inhaler devices as well as their relationships with disease control. Of the study population, 37% of the patients used inhalators correctly. The prevalence in females and those ≥ 55 * years old and asthmatic patients was 59.0%, 54.0%, and 83.0%; respectively. The elderly and patients with a low education level were significantly more likely to make an error performing the technique. Only a third of patients had controlled asthma. This study found the majority of patients use their inhalers incorrectly.

KEYWORDS

Inhalation Technique, Inhaler use, Asthma, COPD

INTRODUCTION

Bronchial asthma and chronic obstructive pulmonary disease (COPD) are common conditions that have a significant impact on patient's health and quality of life.[1] Globally, it is estimated that there are 384 million COPD cases and another 334 million individuals are living with asthma.[2] In Saudi Arabia (SA), about 4.2% of the population have COPD,[3] and 11.3% have asthma.[4]

Although asthma can be managed in some cases, It is not uncommon that asthma patients are unable to control the disease. In fact, the prevalence of uncontrolled asthma reported in studies from the United States, Europe, and Asia is as high as 50%.[5–6] In SA, a higher prevalence of uncontrolled asthma of 64% is reported.[8] Therefore, following clinical guidelines it comes to proper management, such as inhaler use, is a significant contributor to coping with the disease and improved outcomes.

Proper management of these conditions is associated with improving patient's quality life.[9] Part of the management of COPD and asthma depends on the use of inhaler devices to deliver medications.[10] Therefore, the correct inhalation technique is instrumental, and it is achieved when proper skills are performed by the patient for effective drug delivery to the lung. Inhalation techniques can be subclassified into what is known as critical steps. If a patient made one or more errors in these steps, drug uptake to the lungs is significantly reduced leading to diminished effectiveness.[11-12]

Previous literature suggests that not all patients follow correct directions when they use inhalers, and this is not limited to a particular type of inhaler. Despite the fact that several inhaler devices are available in the market, patients may use inhalers incorrectly regardless of the type used. According to a study, 90% of patients performed at least one error in inhaler technique across all devices.[14] Furthermore, 70–80% of asthmatic patients are unable to use their inhaler correctly.[15] Consequently, the failure to use the inhaler correctly may lead to poor disease control and more frequent visits to the emergency department.[16]

Patient characteristics have been found to be associated with improper inhaler use. For example, it has been reported that errors are more common among obese, female patients and the elderly.[17] On the other hand, some literature suggested that healthcare professionals may lack the knowledge to train patients on how to use inhaler devices.[15] Two Saudi studies have reported that community pharmacists failed to demonstrate proper inhalation technique of pMDI inhaler.[18-19]

There is some literature from central SA that described inhaler techniques among asthmatic or COPD patients and their association with adverse outcomes, such as uncontrolled disease.[16-20-21-22] However, some of these studies focused on hospitalized or emergency patients. Furthermore, there is no study conducted to assess inhaler technique in the eastern province among those diagnosed with asthma and COPD. Patients demographic and disease prevalence in the eastern part of SA may differ from other regions. Therefore, due to the lack of information about inhaler technique in the region, this study aims to estimate the prevalence of proper use of inhaler devices and explore factors affecting improper technique among patients visiting a tertiary hospital.

METHODS:

This is a cross-sectional observational study conducted in the pulmonary clinic of King Abdulaziz Hospital in Al Ahsa. This facility is the second big hospital in Al Ahsa and has a 332-bed capacity, and provides primary, secondary and tertiary care to National Guard personnel, their dependents. Data collection for the analysis took place between October 2017 and January 2018. The inclusion criteria were: 1) patients visiting the pulmonary clinic; 2) at least 18 years or older with a diagnosis of bronchial asthma or COPD, and 3) had used an inhaler device for at least three months. Consecutive patients attending the three pulmonary clinics per week were asked to participate in the study. This study was approved by the Institutional Review Board of King Abdullah International Medical Research (KAIMRC).

Data was collected using a structured questionnaire and comprised of four parts. First, patient's information including age (young [15-34] years, middle age [35-54] years, or old age [55 years and more]), gender, marital status, diagnosis, duration of disease (1-9, 10-19, or 20 years and more), educational level, smoking status, and history of smoking in the family.

Second, we ascertained variables that might affect correct inhaler use. These included the how many years the patient has used inhaler device (1-9, 10-19, or 20 years and more), knowledge of how to use the inhaler, duration since last education (< 6 months or 6 months and more), learning method (demonstration, or leaflet), trainer's credentials (physician, pharmacist, others), number of inhalers used (one type vs. more than one) and type of devices (MDI, MDI with spacer, Turbuhaler, Diskus, MDI puls Turbuhaler, MDI plus Diskus).

Third, we ascertained the level of disease control for asthma or COPD. This included a validated published Arabic version of the asthma control test (ACT) for asthmatic patients (controlled, partial controlled, or uncontrolled). In addition, we administered GOLD ABCD assessment of symptoms and risk of exacerbation for COPD patients based on validated published Arabic version of the COPD Assessment Test (CAT) [23-24] A CAT score <10 means fewer symptoms while a CAT score ≥10 indicates more symptoms. We also ascertained

the history of acute exacerbations (emergency visit) or hospitalization in the past year (0 or 1 exacerbations without admission, ≥2 exacerbations or ≥1 hospitalization).

The GOLD ABCD was classified as following: Group A (Low risk, less symptoms: 0 to 1 exacerbation per year and no prior hospitalization for exacerbation; and CAT score <10), Group B: (Low risk, more symptoms: 0 to 1 exacerbation per year and no prior hospitalization for exacerbation; and CAT score ≥10), Group C: (High risk, less symptoms: ≥2 exacerbations per year or ≥1 hospitalization for exacerbation; and CAT score <10), Group D: (High risk, more symptoms: ≥2 exacerbations per year or ≥1 hospitalization for exacerbation; and CAT score ≥10).

Finally, the questionnaire included a checklist adapted from Batterink et al. study [13] to assess the different steps of inhaler device techniques [Figure 1] Two physicians validated the questionnaire. The tool included a scoring system recording response according to the inhaler-specific checklist. Each performed step of the scoring system was given a value of one, and a non-performed step was assigned a value of zero. A score of the number of critical errors for each specific device was computed to determine the inhalation technique as either correct technique (defined as making < 1 critical errors), or incorrect (defined as ≥1 critical errors).

Figure: Checklist for the correct technique for each of 5 inhaler devices.

MDI
1. *Remove cap
2. *Shake well
3. Breath out normally
4. Keep head upright or slightly tilted
5. Seal lips around mouthpiece
6. *Inhale slowly, actuating once during first half of inhalation
7. *Continue slow and deep inhalation
8. Hold breath for 5 or more seconds

MDI with spacer
1. *Remove caps
2. *Shake MDI well
3. Insert MDI into spacer
4. Breath out normally
5. Seal lips around mouthpiece
6. *Actuate MDI
7. *Inhale slowly and deeply
8. Hold breath for 5 or more seconds

Diskus
1. *Open to expose mouthpiece
2. *Slide lever until click heard
3. *Keep level throughout
4. Breath out normally and away from inhaler
5. Seal lips around mouthpiece
6. *Inhale forcefully and deeply
7. Hold breath for 5 or more seconds
8. Exhale but not through inhaler

Turbuhaler
1. *Hold upright without occluding air vents
2. *Turn colored wheel one way, then back
3. Breathe out normally and away from mouthpiece
4. Seal lips around mouthpiece without occluding air vents
5. *Inhale forcefully and deeply
6. Hold breath for at least 5 seconds
7. *Exhale but not through inhaler

HandiHaler
1. *Open lid and mouthpiece
2. *Place capsule in chamber
3. Close mouthpiece, ensuring click is heard
4. *Holding inhaler upright, press blue button fully
5. Breath out normally and away from inhaler
6. Seal lips around the mouthpiece
7. Inhale forcefully and deeply so that capsule vibrates
8. Hold breath for 5 or more seconds
9. *Repeat steps 6-8

MDI - metered dose inhaler, *steps that are critical, incorrect performance of which would lead to little or no medication reaching the lungs. Republished Copyright permission from: Batterink J, Dahri K, Aulakh A, Rempel C, Can J. Evaluation of the use of inhaled medications by hospital inpatients with chronic obstructive pulmonary disease. Hospital Pharmacy 2012; 65(2): 111-118.

The investigator collected the data after interviewing each patient, except for the third part where the investigator asked the patient to complete the ACT or CAT. For illiterate patients, the investigator explained each question and documented the answer.

The data was analyzed using Statistical Packages for Social Sciences (SPSS) Version 21.0. Descriptive data were expressed as percentages to summarize categorical variables while means and standard deviations were used to summarize continuous variables. Chi-squared tests were used to test the association between correct use of inhalation devices across sociodemographic and disease control level and other variables. A logistic regression model was also constructed to examine the association between correct use and disease control. P-values <0.05 were considered significant.

RESULTS:

During the study period, 291 patients attended 25 pulmonary clinics. Of those, 134 patients have the diagnosis of asthma or COPD, and only 100 patients were eligible for inclusion in the study. Among the patient sample, 54.0% were 55 years or older, 59.0% were female, 77.0% were married [Table 1]. On the other hand, 55.0% have a low education level, and 25% were smokers. The majority of patients were asthmatic 83.0% while the remaining 17.0% were COPD patients.

[Table *1*] Distribution of the Demographic characteristics of patients (n=100)

Variable	*N (%)*
Age groups	
15-34 old	10.0
35-54 old	36.0
55 old and more	54.0
Gender	
Male	41.0
Female	59.0
Marital Status	
Married	77.0
Non Married	23.0
Diagnosis	
Asthma	83.0
COPD	17.0
Duration of Disease	
1 to 9 Years	44.0
10 years and more	56.0
Education Level	
Low Education	55.0
Average Education	20.0
High Education	25.0
Smoking Status	
Smoker	25.0
Non-Smoker	75.0
Previously educated on using inhalers	
Yes	90.0
No	10.0
Type of inhaler used	
One type	39.0
More than one type	61.0
Type of Devices	
MDI	27.0
MDI with spacer	1.0
Turbuhaler	11.0
Diskus	0
MDI + Turbuhaler	50.0
MDI + Diskus	11.0

Over half of the patients' population 56.0% have had the disease for ten years or more. In addition, 61.0% used more than one type of inhaler. The majority of patients 90.0% had educated previously on how to use inhalers, and of those, 82.2% had been educated by a physician.

The prevalence of correct inhalation technique among the patient population is 37.0% . There was a variation in asthma control among patients. In the month preceding the visit, asthma was completely controlled among 39.8% of the patients, partially controlled among 26.5% of patients and uncontrolled among about a third of all patients 33.7%.

According to the GOLD ABCD assessment for COPD, 58.8% of patients were considered as group B (have low risk, more symptoms). Of those, 88.2% had CAT score ≥10. In addition, 82.4% had a history of 0 or 1 acute exacerbations in the past year [Table2].

[Table 2] :Assessment of Inhalation Technique and the level of disease control among patients (N=100)

Variable	*N (%)*
Inhalation Technique	
Correct Technique	37 (37.0)
Incorrect Technique	63 (63.0)

The level of control for an asthmatic patient (ACT) (n=83)	33 (39.8)
Controlled	22 (26.5)
Partial controlled	28 (33.7)
Uncontrolled	
GOLD ABCD assessment for COPD Patient (n=17)	
Group A	2 (11.8)
Group B	10 (58.8)
Group C	0
Group D	5 (29.4)
COPD Assessment test	
CAT score <10	2 (11.8)
CAT score ≥10	15 (88.2)
History of acute exacerbations the past year	
0 or 1 exacerbations	14 (82.4)
≥2 exacerbations	3 (17.6)
History of Hospitalized in the past year	
Yes	4 (23.5)
No	13 (76.5)

According to the regression analysis, older age was significantly associated with incorrect inhalation technique when compared with the younger age group. Moreover, patients with a low education level were more likely to perform incorrect technique than those with average, or high education level (OR=3.1, P=0,03; [Table 3]). The remaining variables were not statistically significant. Patients who performed incorrect technique were over two times to report uncontrolled asthma, but this result was insignificant (OR= 2.82, P< 0.63 [Table4]).

DISCUSSION:

Our study found over two-thirds of patients performed incorrect inhalation technique. We also found that 63.0% of patients made at least one critical error. These findings highlight the need for further investment in patient's education to improve proper use and ultimately health outcomes. Our findings may be used to guide interventions aimed to improve the correct use of inhalers, especially among patients older than 55 years and among those with low education levels.

Our study finding is similar to a study by Batternick et al. among hospitalized patients, where 59% committed one or more critical errors.[13] On the other hand, our estimate of incorrect inhaler use is smaller than a study conducted in Riyadh among hospitalized patients which reported that 70% of patients misuse inhalers.[22] This also concurs with a previous global study that suggested that 70-80% of patients are unable to use their inhaler correctly.[15] Finally, a recent systematic review, indicate that incorrect inhaler technique has not improved over the past 40 years, and the prevalence of correct technique was 31%.[25]

The estimated prevalence of incorrect use reported here is considered high. The surprising finding may be due to several reasons. First, factors related to the patient characteristics as age, gender and the level of education. The majority of our patient included in the study were old female with a low education level. These characteristics have been reported in many previous studies to be associated with incorrect inhalation technique. Second, factors related to the device itself. There are different types of inhaler devices available to patients. Each one demand a specific physical skill, which may lead to confusion and increase the likelihood of technical errors. Clinicians should take this into account and consider the patient's preferences and should ensure a patient understands the steps and re-evaluate techniques periodically. Third, factors related to healthcare professional may explain in part the present findings. Previous studies showed the majority of healthcare providers responsible for training patients on the correct technique lacked knowledge about handling inhaler devices.[19-26-27]

Similar to previous literature, older patients were found to be more likely to perform the inhalation technique incorrectly.[28] In addition, our study is consistent with previous analysis which reported that low education level was associated with incorrect use[12-28]

Our study also found about a third of asthmatic patients report uncontrolled asthma. Although the finding was not significant, the result showed that incorrect use is associated with a higher likelihood of uncontrolled asthma. This concurs with a previous study in which improper technique is associated with poor asthma control and frequent ED visits.[16] It is possible that the lack of significance to be due the small sample size.

This study has a couple of strengths that should be considered. First, the same investigator evaluated all patients to avoid interobserver variability. Second, to the best of our knowledge, this is the first study in Saudi Arabia to determine the prevalence of correct inhalation technique, and this is the first study to use the GOLD ABCD assessment of the patients quality of life.

Nevertheless, some limitations need to be taken into consideration in light of these findings. First, the study included a small number of patients from a single hospital. Therefore, the generalizability remains unclear to the entire country. Also, the adequacy of inspiratory flow was not assessed for COPD patients as we depended only on GOLD ABCD assessment to determine the level of COPD control. This may introduce bias, but it is not likely to be substantial.

[Table 3]: Relation of technique correction and patient characteristics related to use inhaler devices in (N= 100) subject:

Variable	*Correct Inhalation Technique*	*Incorrect Inhalation Technique*	*P-value*	*OR*	*95%CI*
Age group					
15-34 old	6 (60.0)	4 (40.0)	-	-	-
35-54 old	18 (50.0)	18 (50.0)	.577	1.500	(0.36 – 6.23)
55 old and more	13 (24.1)	41 (75.9)	.031	4.731	(1.15 –19.39)
Gender					
Male	18 (43.9)	23 (56.1)	.233	.607	(0.27 – 1.38)
Female	19 (32.2)	40 (67.8)			
Marital Status					
Married	29 (37.7)	48 (62.3)	.802	.883	(0.33 – 2.34)
Non Married	8 (39.8)	15 (65.2)			
Diagnosis					
Asthma	31 (37.3)	52 (62.7)	.873	.915	(0.31 – 2.72)
COPD	6 (35.3)	11 (64.7)			
Duration of Disease					
1 to 9 Years	20 (45.5)	24 (54.5)	.121	.523	(0.23 – 1.19)
10 years and more	17 (30.4)	39 (69.6)			
Education Level					
Low Education	14 (25.5)	41 (74.5)	.033	3.173	(1.18 – 8.56)
Average Education	10 (50.0)	10 (50.0)	.048	1.083	(0.33 – 3.51)
High Education	13 (52.0)	12 (48.0)	-	-	-
Smoking Status					
Smoker	11 (44.0)	14 (56.0)	.403	.675	(0.27 – 1.69)
Non-Smoker	26 (34.7)	49 (65.3)			
Previously educated on using inhalers					
Yes	35 (38.9)	55 (61.1)	0.241	2.545	(0.51 –12.69)
No	2 (20.0)	8 (80.0)			

Type of inhaler used					
One type	17 (43.6)	22 (56.4)	.275	0.631	(0.28 – 1.45)
More than one type	20 (32.8)	41 (67.2			
Type of Devices					
MDI	11 (40.7)	16 (59.3)	0.602	-	-
MDI with spacer	0	1 (100)		0.831	(0.19 – 3.54)
Turbuhaler	6 (54.5)	5 (45.5)		0.000	0.000
MDI +Turbuhaler	16 (32.0)	34 (68.0)		0.476	(0.09 – 2.63)
MDI + Diskus	4 (36.4)	7 (63.6)		1.214	(0.31 – 4.75)

[Table 4] Relation of technique correction and Disease control

Variable	*Correct Technique N (%)*	*Incorrect Technique N (%)*	*P- Value*	*OR*	*95%CI*
The level of control for asthmatic patient (ACT) (N=83)					
Controlled	16 (48.5)	17 (51.5)	0.167	-	
Partial controlled	8 (36.4)	14 (63.6)		1.647	(0.546 – 4.972)
Uncontrolled	7 (25.0)	21 (75.0)		2.824	(0.945 – 8.435)
GOLD ABCD assessment for COPD Patient (N=17)					
Group A	1 (50.0)	1 (50.0)	0.145	-	-
Group B	5 (50.0)	5 (50.0)		0.000	-
Group C	0	0		-	-
Group D	0	5 (100)		0.000	-

CONCLUSION:

In summary, this study found the majority of patients to perform inhalation technique incorrectly. This, in turn, may be associated with poor asthma control and warrant further investment by healthcare professional to ensure proper inhaler use. The study findings may be used to guide interventions aimed to improve the correct use of inhalers, especially among patients older than 55 years and among those with low education levels.

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