Original article

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Evaluation of Inhaler Technique In COPD And Asthma Patients

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Abstract

Background: Asthma and COPD remain poorly controlled diseases that significantly affect the quality of life of patients. Inhalers are the main therapeutic options. Poor inhaler technique is a major factor that leads to poor clinical consequences, affecting the effectiveness of treatment and further control of symptoms. Aim of the Study: the present study aims at evaluating the inhaler technique and its clinical consequence in COPD and asthma patients .Patients and Methods: This is a cross sectional study of 70 patients, 35 with COPD and 35 with Asthma, who are already on inhaler drugs in their treatment. The use of inhaler was evaluated by a checklist that contains seven steps of inhaler use; by asking the patients to use their inhalers as usual, the correct or incorrect steps were recorded. The result of each patient checklist was correlated with the patient demographic parameters and level of control of his disease (COPD or asthma) by using COPD assessment test (CAT) or asthma control test (ACT) respectively. The Results: A total of 70 patients were enrolled in this study; 35 had COPD and 35 were asthmatic. The COPD patients were significantly older than asthmatic, mean age was 65.5 ± 5.8 (range: 55 - 75) years and $36.4 \pm$ 13.9 (range: 16 - 65) years, respectively. (P. value < 0.05). Males were dominant among COPD patients than asthmatic group; they contribute to 80% and 45.7%, respectively, (P. value < 0.05). The level of education was not significantly different between the groups (P > 0.05). Current smokers were significantly more frequent in COPD group than in asthmatic group, 40% vs. 14.3%, respectively. The duration of inhaler use was significantly longer in asthmatics than in the COPD group members; the mean duration of use was 5.2 ± 4.5 (range: 1 - 20) years in asthmatic compared to 2.4 ± 1.1 (range: 1 - 6) years in COPD group. Dry powder inhalers (DPI) were relatively more frequently used than metered dose inhalers (MDI) where DPI used by 51.4% and 54.3% in COPD and asthmatic group, respectively. The level of education of patients and longer duration of inhaler use correlate positively with good technique, while no significant correlation with other variables. Conclusion: A large proportion of the participants had a poor inhaler technique regardless of the type of disease and of inhaler (DPI or MDI). There was a positive correlation between proper use of inhaler and high educational level of patients and longer duration of use.

Keywords : Asthma, COPD, Inhaler, Technique.

INTRODUCTION

Asthma and chronic obstructive pulmonary disease (COPD) are obstructive lung diseases which are characterized by chronic inflammation. an increase in mucus production, and highly prevalent conditions. Lung diseases are globally among the leading causes of death with asthma, being one of the most prevalent respiratory diseases. They affect people of all ages but, despite effective therapies available, many patients are poorly controlled and have a low quality of life. Various inhalation devices with different classes of medications are the foundation as therapies in both asthma and COPD. However, the lack of disease control in asthma and COPD patients may be due to numerous reasons. The association between nonadherence to guidelines on the part of the health care provider and poor inhalation technique and/or non-adherence to the prescribed treatment plan by the patients is common. It is therefore essential to discuss the different delivery systems and the methods used in asthma and COPD patients (1). The prevalence of COPD was 15.1% among sample of adult smokers in Baghdad, Iraq, according to Al Lami et al. (2). Until now, no definite study assess the prevalence of asthma among adult Iraqi people. Inhaler use offers several advantages but requires the user's proper mastery. The issue of inhaler technique is very important as inhaler misuse remains common in real life regardless of the inhaler used and is associated with poor disease control. Despite technological advancements, an easy-to-use device is not yet available. (3)Medication for asthma and COPD consists mainly of inhaled pharmaceuticals(4,5). Metered-dose inhalers (MDIs), dry powder inhalers (DPIs), nebulizers and soft mist inhalers (SMIs) are currently commercially available devices for administering inhaled

medicines(6). The effectiveness of inhaled medication requires patients to adhere to their medication and have correct inhalation technique (7). Previous studies show that the errors in the use of device are common in the patients using inhaled medications(6, 8). According to Chrystyn et al., 50–100% of the patients with DPIs or MDIs fail to use their inhaler correctly(8).Poor inhaler technique and poor adherence are major problems. WHO has estimated that only 50% of the chronic patients are adherent to long-term chronic therapies (9). According to the systematic review published in 2016, only 31% of patients have been able to use an inhaler correctly, and the inhaler technique has not improved over the past 40 years(10). It is essential to review the inhalation technique in all the patients with asthma and COPD due to the high socio-economic impact that it involves: an effort must be made to homogenize the evaluation of inhalation technique, so that it helps to transmit a clear message to the patients, as well as to the health professionals on what is and what is not correct maneuver(11). The literature a highlights the fact that the definitions of critical and non-critical errors, as well as the number and type of checklist steps, vary widely between different devices and studies. A critical error is one that may impact the effectiveness of the delivered drug and thereby lead to the sub-optimal disease control of asthma and COPD, whereas a non-critical error is one of the checklist steps for a particular device that is not classified as critical (8). The most common available drugs used as inhaler is shown in Tab. 1. below (12):

Aim of the study : The present study aims at evaluating the inhaler technique and its clinical consequence in COPD and asthma patients.

Table No. 1: Available inhaled medications in asthma and COPD (12).

Beta-2 Agonist (Short Acting Beta-2 Agonist & Long Acting Beta-2 Agonist)

Anticholinergics (Short Acting Muscarinic Antagonist & Long Acting Muscarinic Antagonist)

Inhaled Corticosteroids

Combination of Inhaled Corticosteroid and/or Long Acting Beta-2 Agonist and/or Long Acting Muscarinic Antagonist in one inhaler

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Mucolytics

PATIENTS AND METHODS

This cross-sectional study was conducted from December 2021 to February 2022 in Al-Sader Teaching Hospital in Najaf, Iraq. The patients were randomly included from the outpatient clinic and inpatient medical wards. The participants in this study are 35 patients diagnosed with chronic obstructive pulmonary disease and 35 patients diagnosed with bronchial asthma who use an inhaler in their treatment. Demographic information

was taken for each patient such as age, sex, educational and smoking status. Due to the short period of this study and the highly selected patients, the sample size was small, hoping for more number of participants in the next future studies. The method of using the inhaler was evaluated by asking the patient, "Can you show me how to use the inhaler as usual?" through a checklist that contains seven steps for using the inhaler, as in Tab. 2. below, after which the number of correct and incorrect steps is shown (13).

 Table No. 2. Modified steps of inhaler use technique checklist (13)

Steps in sequence
1-Prepare the inhaler device
2-Prepare or load the dose
3-Breathe out, fully and gently, but not into the inhaler
4-Place inhaler mouthpiece in the mouth and seal the lips around the mouthpiece
5-Breathe in: MDI: slow and steady, DPI: quick and deep
6-Remover inhaler from the mouth and hold the breath for up to 10 seconds
7-Mouth wash

The result of each patient checklist was correlated with the patient demographic parameters and level of control of his disease, COPD or Asthma, by using COPD assessment test (CAT) or asthma control test (ACT) respectively. Regarding the CAT score results, (14) classified them into four groups as: Low impact, less than 10; Medium impact, from 10- 20; High impact, from 21-30; Very high impact, more than 30. Regarding to asthma control test (ACT)

(15) score result classified into three group a s: Poorly controlled less than 16; Not well controlled 17- 19; Well controlled 20-25.

Statistical analysis

A statistical analysis was performed by using the statistical package for social sciences (SPSS) version 27. Descriptive statistics were presented according to the type of variables as frequencies, percentage, mean standard deviation, and range. Chi-square test was used to compare frequencies; Fisher's exact test was used as an alternative when chi square was inapplicable. Student's t test was used to compare two means; age of COPD and Asthmatic group, mean ACT score and CAT score between correct and incorrect response in each step. Analysis of variances (ANOVA) was used to compare the mean of the total score of the correct use for the seven steps across the level of education and duration of inhaler use. Kendall's tau analysis was used for the assessment of the effect of patients' characteristics on the correct use of inhaler. The regression curve estimation plot was used to assess the correlation between total ACT or CAT score against the total score of the correct use. The categorization of CAT score of patients according to the impact on health and the ACT score according to control of asthma were adopted from Gregoriano et al.(16) and Kebede et al. (17). Any p-value less than 0.05 was considered statistically significant.

Your name:		5	TAT
Today's date:			
How is your COPD? Take th This questionnaire will help you COPD (Chronic Obstructive Pull answers and test score can be u the management of your COPD	e COPD Assessment Te and your healthcare profess monary Disease) is having o used by you and your health and gain the greatest benefit	est [™] (CAT) sional to measure the impact that on your wellbeing and daily life. Y ocare professional to help improve fit from the treatment.	our e
For each item below, place a ma Please ensure that you only sele	ark (X) in the box that best o ect one response for each q	lescribes your current situation. uestion.	
Example: I am very hap		I am very sad	
		Y	SCORE
I never cough	0 1 2 3 4 5	I cough all the time	
I have no phlegm (mucus) on my chest at all	0 1 2 3 4 5	My chest is full of phlegm (mucus)	
My chest does not feel tight at all	0 1 2 3 4 9	My chest feels very tight	
When I walk up a hill or a flight of stairs I am not out of breath	0 1 2 3 4 5	When I walk up a hill or a flight of stairs I am completely out of breath	
I am not limited to doing any activities at home		I am completely limited to doing all activities at home	
l am confident leaving my home despite my lung condition	0 1 2 3 4 6	I am not confident leaving my home at all because of my lung condition	
I sleep soundly	0 1 2 3 4 3	I do not sleep soundly because of my lung condition	
I have lots of energy	0 1 2 3 4 3	I have no energy at all	
		TOTAL SCORE	
COPD assessment test was developed SK's activities in connection with the CC dependent experts, one of which is chai CAT, the COPD assessment test and the ghts reserved.	by an interdisciplinary group of ini PD assessment test are monitore r of the council. CAT logo are trademarks that bel	ternational COPD experts with support f d by a supervisory council that includes ong to the GSK group of companies. ©2	rom GSK. external, 2009 GSK. All

Figure No.1: COPD assessment test (CAT) (14).

Recognize Clinically	st that pro d by the f validated a	ovides a nume National Institu against spiror 2 Years	erical sco utes of H netry and and (re to assess as ealth (NIH) in it I specialist ass Dider: ^{1. A}	sthma co ts 2007 a essment Answer ea	ntrol. Isthma guideli . ² Ich question ar	nes.' nd write th	ne answer nu	mber in the b	ox to the right
				2. A 3. D	dd your a Discuss yo	answers and w our results with	rite your f your doo	total score in ctor.	the TOTAL bo	x shown below
. In the past 4	weeks, ho	w much of the	time did y	our asthma keep	you from	getting as mucl	n done at v	work, school or	at home?	SCORE
All of the time	1	Most of the time	2	Some of the time	3	A little of the time	4	None of the time	5	
2. During the p	ast 4 wee	ks, how often l	have you l	had shortness o	f breath?					
More than	(1)	Once a day	2	3 to 6 times	3	Once or twice	4	Not at all	5	
or pain) wał 4 or more nights a week	te you up a	t night or earli 2 or 3 nights a week	er than us	ual in the morni Once a week	3	Once or twice	4	Not at all	5	
4. During the p	past 4 wee	ks, how often	have you	used your rescu	e inhaler	or nebulizer me	dication	(such as albu	terol)?	
times per day	(1)	per day	2	per week	3	or less	4	Not at all	5	
5. How would	you rate yo	ur asthma cor	ntrol durin	g the past 4 we	eks?					
Not controlled at all	1	Poorly controlled	2	Somewhat controlled	3	Well controlled	4	Completely controlled	5	
If your score doctor abour These answ In the past 1 (that did not	e is 19 or t your res ers shou 2 month result in	less, your a sults. The an Id be discuss s, how many a hospitaliz	sthma m iswers b sed with y emerge ation)?	nay not be und elow should r your doctor. ency departm	der cont not be ac nent visit	rol. Be sure t dded to your s have you h	o talk wi total sco ad due t	ith your ore. o asthma		TOTAL
In the past 1	2 month	s, how many	y inpatie	nt hospitaliza	tions ha	ve you had d	lue to as	thma?		
Copyright 2002 Asthma Control The Asthma Cor	, by Quality Test is a tr ntrol Test is	Metric Incorpor ademark of Qua	rated. alityMetric h asthma 1	Incorporated. 2 years and olde	н.					
	Department of	Health and Human	Services, Na	tional Institutes of He	alth, Nationa	I Heart, Lung, and B	lood institute	Expert Panel Replander 10, 2007, 2	ort 3: Guidelines for Nathan BA et al.	r the Diagnosis and I Allergy Clin Immuno

Figure No.2: Asthma control test (ACT) (15)

RESULTS

A total of 70 patients were enrolled in this study; 35 had COPD and 35 were asthmatic. The COPD patients were significantly older than asthmatic, the mean age was 65.5 ± 5.8 (range: 55 - 75) years and 36.4 ± 13.9 (range: 16 - 65) years, respectively; age distribution and other demographic characteristics of the studied groups are summarized by Tab. 3.

Regarding the type of inhaler used by patients, dry powder inhalers (DPI) were relatively more frequently used than metered dose inhalers (MDI) where DPI was used by 51.4% in COPD group and 54.3% in asthmatic group. The source of teaching about the inhaler use was mainly by physicians, 88.6% in each group, pharmacist was the source of teaching about use to only 4 patients in each group, 11.4%, (Tab. 4). The distribution of correct and incorrect steps of inhaler use regarding the type

of inhalers is shown in Tab. 5. Totally, the distribution of patients according to the number of correct steps on inhaler technique they performed is demonstrated in, according to the type of disease and type of inhaler, respectively. In general, 2 patients (2.9%) did not have any correct step, 3 (4.3%) had one, 10 (14.3%) had two, 18 (25.7%) had three, 14 (20%) had four, 10 (14.3%) had five and 12 (17.1%) had six correct steps while only one patient had been correctly performed the all 7 steps, however, no significant difference had been reported in the number of correct steps performed by the patients, neither according to the disease they did have nor the type of inhaler they did use, (P. value > 0.05), (Tab. 6 & 7).

For the primary assessment of the effect of patients' characteristics on the correct use of inhaler, Kendall's tau b bivariate analysis was performed by using patient's age, gender, and level of education, type of disease, and duration of using the inhaler as independent variables against the total score for correct use, for the 7 steps. This analysis revealed only two significant correlation; with level of education and duration of use of inhaler, while no significant correlation with other variables, (Tab. 8). Hence, for more precise assessment of this correlation, the variables that appeared to have significant effect on correct use of inhaler; Patient's level of education and duration of use were further assessed by using the ANOVA test, which showed a direct positive correlation trend between the level of education and the total score of the correct use. for the 7 steps, where patients with higher level of education and longer duration of inhaler use were more likely to use inhaler correctly (Tab. 9 and Fig. 3).

The mean CAT score was 25.6 ± 6.7 , range: 12 – 37, and the mean ACT score was 15.6 ± 5.5 , range: 6 – 25, as shown in (Tab. 10). Moreover, according to cut-off points of CAT,

none of the patients had low impact on health while the impact on health was medium in 11, high in 14 and very high in 10 patients as shown in (Tab. 11).

To assess the correlation between the type of inhaler from one side as independent variable and each of impact on health in COPD patients and asthma control in asthmatics (as dependent variable) chi-square test used which showed a statistically insignificant correlation in both comparisons indicated no significant effect for the type of inhaler on the impact of health or asthmatic group, according to cut-off points of ACT score, asthma was poorly controlled in 15 patients, not well controlled in 9 and well controlled in 11 (Tab. 12).

The comparison of the ACT mean total score in asthmatic patients according to correct and incorrect practice per each step revealed that higher the ACT mean score was significantly reported in patients with correct practice of steps 1, 2, 3, 4, 5, and 6 where in all the comparisons P. value < 0.05. In step 7, the patients who correctly applied this step also had an ACT higher mean score, though the did difference not reach a statistical significance (P > 0.05). From another point of view, the correlation between the ACT total score and correct use total score for the 7 steps was assessed with regression curve estimation showing an almost direct linear correlation between these two parameters, (Tab. 13).

For the correlation between the CAT total score and correct application of the 7 steps of inhaler use, it had been significantly found that patients who were correctly use the inhaler had lower CAT mean score in all steps, (P. value < 0.05), except the 7th (P. value >0.05). The CAT total score showed almost linear inverse correlation with the total 7 steps score for the correct use of inhaler, (Tab. 14).

Variable -		COPD	(n=35)	Asthma (n=35)		
	v ariable		%	No.	%	
1 22	Mean ± SD		± 5.8	36.4 =	± 13.9	
Age	Range	55 -	- 75	16 -	- 65	
	Gender					
	Male	28	80.0	16	45.7	
	Female	7	20.0	19	54.3	
	Education					
	Illiterate	8	22.9	5	14.3	
	Primary	5	14.3	4	11.4	
I	ntermediate	7	20.0	4	11.4	
	Secondary	7	20.0	9	25.7	
Ins	titute/college	8	22.9	13	37.1	
	Smoking					
Cu	irrent smoker	14	40.0	5	14.3	
]	Ex-smoker	15	42.9	1	2.9	
Ν	lon-smoker	6	17.1	29	82.9	
Durat	ion of use (year)					
	< 2	9	25.7	4	11.4	
	2-3	20	57.1	12	34.3	
	4-5	5	14.3	7	20.0	
	> 5	1	2.9	12	34.3	
	Mean	2.4 =	± 1.1	5.2 ± 4.5		
	Range	1 -	- 6	1 -	20	

Table NO.3: Demographic characteristics of the studied group. Standard deviation of mean (SD)

Table NO.4: Source of teaching about the use of inhaler. Metered Dose Inhaler (MDI), Dry Powder Inhaler (DPI).

Variable	COPE	D (n=35)	Asthma (n=35)		
		No.	%	No.	%
Type of inhaler	DPI	18	51.40	19	54.3
Type of minater	MDI	17	48.60	16	45.7
Source of teaching	Physician	31	88.60	31	88.6
Source of teaching	Pharmacist	4	11.4	4	11.4

Table NO.5: Distribution of correct and incorrect steps of inhaler use regarding the type of inhalers. Metered Dose Inhaler (MDI), Dry Powder Inhaler (DPI).

Step	Use	DPI(n	u = 37)	MDI(n = 33)		P. value	
		No.	%	No.	%		
Propert the inheler device	Correct	34	91.9	28	84.8	0.562	
riepare the initiater device	Incorrect	3	8.1	5	15.2	0.302	
Prepare or load the dose	Correct	32	86.5	28	84.8	0.241	
riepare of load the dose	Incorrect	5	13.5	5	15.2	0.241	
Breathe out, fully and gently,	Correct	10	27	9	27.3	0.606	
but not into the inhaler	Incorrect	27	73	24	72.7	0.000	
Place inhaler mouthpiece in the	Correct	29	78.4	26	78.8		
mouth and seal the lips around the mouthpiece	Incorrect	8	21.6	7	21.2	0.532	
Breathe in: MDI: slow and	Correct	17	45.9	12	36.4	0.417	
steady, DPI: quick and deep	Incorrect	20	54.1	21	63.6	0.417	
Remover inhaler from the	Correct	18	48.6	15	45.5		
mouth and hold the breath for up to 10 seconds	Incorrect	19	51.4	18	54.5	0.455	
Mouth wash	Correct	3	8.1	1	3	0.361	
WOULI WASH	Incorrect	34	91.9	32	97	0.361	

Table NO. 6: Number of correct steps of inhale	r technique performed by patients
according to the disease.	

Number of correctly		Dise	Total $(n - 70)$				
number of confectly	COPD (n=35)		Asthma	(n=35)	10tar(11 - 70)		
performed steps	No.	%	No.	%	No.	%	
None	0	0.0	2	5.7	2	2.9	
One	3	8.6	0	0.0	3	4.3	
Two	6	17.1	4	11.4	10	14.3	
Three	12	34.3	6	17.1	18	25.7	
Four	6	17.1	8	22.9	14	20.0	
Five	3	8.6	7	20.0	10	14.3	
Six	5	14.3	7	20.0	12	17.1	
Seven	0	0.0	1	2.9	1	1.4	

Table NO.7: Number of correct steps of inhaler technique performed by patients according to the type of inhaler. Metered Dose Inhaler (MDI), Dry Powder Inhaler (DPI).

Number of correctly		Type of	Total				
number of confectly	DPI (n = 37)		MDI (1	n = 33)	Total		
performed steps	No.	%	No.	%	No.	%	
None	2	5.4	0	0.0	2	2.9	
One	1	2.7	2	6.1	3	4.3	
Two	3	8.1	7	21.2	10	14.3	
Three	10	27.0	8	24.2	18	25.7	
Four	8	21.6	6	18.2	14	20.0	
Five	6	16.2	4	12.1	10	14.3	
Six	7	18.9	5	15.2	12	17.1	
Seven	0	0.0	1	3.0	1	1.4	

Table	NO.8:	Results	of H	Kendall's	tau_b	bivariate	correlation	analysis	for the
correla	tion b	etween o	correc	et use sco	re for	the 7 step	s and patier	nt charact	teristics.

	Correlation of variable against correct total				
	score				
Variable	<i>R</i> *	P. value			
Age (year)	0.003	0.975			
Gender	-0.036	0.734			
Education	0.254	0.008			
Source of teaching	-0.038	0.721			
Disease	0.129	0.225			
Duration of use	0.525	0.001			

Table NO.9: A Comparison of the total score of correct use (for the 7 steps) according to the level of education and the duration of inhaler use.

Variable		Total score of	D voluo	
		Mean	SD	r. value
	Illiterate	2.46	1.6	
Education	Primary	3.22	1.0	
	Intermediate	3.91	1.4	0.006*
	Secondary	4.06	1.7	
	Institute/college	4.43	1.5	
Duration of use (year)	< 2	2.23	1.1	0.001*
	2 - 3	3.72	1.4	
	4 - 5	4.17	1.7	0.001
	> 5	4.92	1.4	
*ANOVA test used to compare the mean across subgroups				



Figure NO.3: Graphical (modified Box-Plot) presentation of mean values of 7 steps total score of correct use showing the direct correlation between longer use of inhaler and higher correct score.

Table NO.10:	Descriptive statistics of CAT and ACT scores. Standard deviation
of mean (SD).	

Statistics for Total Score	CAT score / COPD group (n=35)	ACT score / Asthma group (n=35)	
Mean	25.6	15.6	
SD	6.7	5.5	
Range	12 - 37	6 - 25	

Table NO.11: CO	PD assessment tes	st and impact or	n the health status.
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Impact level	No.	%
Low impact	0	0.0
Medium impact	11	31.4
High impact	14	40.0
Very high impact	10	28.6
Total	35	100.0

Table NO.12: Distribution of asthmatic patients according to asthma control test levels.

Asthma control test level	No.	%
Poorly controlled	15	42.9
Not well controlled	9	25.7
Well controlled	11	31.4
Total	35	100.0

Table NO.13: Comparison of the ACT mean total score in asthmatic patients according to correct and incorrect practice per step. Standard Deviation of mean (SD).

Step		No. of patients	Total ACT score		D voluo	
			Mean	SD	r. value	
Stop1	Correct	32	16.4	5.0	0.007	
Step1	Incorrect	3	7.0	1.0	0.007	
Stop?	Correct	30	16.7	4.9	0.002	
Step2	Incorrect	5	8.8	3.6	0.002	
Stop3	Correct	13	18.5	3.8	0.013	
Steps	Incorrect	22	13.9	5.6		
Ston/	Correct	24	17.3	4.7	0.007	
Step4	Incorrect	11	12.0	5.5	0.007	
Stop5	Correct	17	17.7	4.8	0.025	
Step5	Incorrect	18	13.6	5.5	0.025	
Step6 -	Correct	19	18.3	4.0	0.001	
	Incorrect	16	12.4	5.5	0.001	
Step7	Correct	2	19.0	2.8	0.375	
	Incorrect	33	15.4	5.6	0.375	

Table No.14: A comparison of the CAT mean total score in COPD patients according to correct and incorrect practice per step. Standard Deviation of mean (SD).

COPD		No. of patients	Total CAT score		D volue	
			Mean	SD	r. value	
Ctore 1	Correct	29	24.4	6.7	0.030	
Step1	Incorrect	6	30.8	3.5	0.030	
Stop?	Correct	27	23.9	5.4	0.008	
Step2	Incorrect	8	30.9	8.0	0.008	
Stop2	Correct	9	20.4	3.8	0.006	
Steps	Incorrect	26	27.3	6.7		
Step4	Correct	28	24.3	6.3	0.023	
	Incorrect	7	30.6	6.0	0.025	
Step5	Correct	10	20.1	5.4	0.001	
	Incorrect	25	27.7	5.9	0.001	
Step6	Correct	14	21.9	5.5	0.006	
	Incorrect	21	28.0	6.3	0.000	
Step7	Correct	4	21.3	7.9	0.179	
	Incorrect	31	26.1	6.4	0.179	

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	Type of inhaler					
Variable	DPI		MDI		P. value	
variable	No.	%	No.	%		
Impact	on Healt	h (COPD	group)			
Medium impact	7	38.9	4	23.5		
High impact	7	38.9	7	41.2	0.551	
very high impact	4	22.2	6	35.3		
Total	18	100.0	17	100.0		
Asthma control (asthmatic group)						
Poorly controlled	7	36.8	8	50.0		
Not well controlled	7	36.8	2	12.5	0.259	
Well controlled	5	26.3	6	37.5		
Total	19	100.0	16	100.0		

Table No.15: The correlation of the type of inhaler with impact on health andasthma control. Metered Dose Inhaler (MDI), Dry Powder Inhaler (DPI).

DISCUSSION

In clinical practice, asthma and COPD remain poorly controlled diseases that significantly affect the quality of life of patients. The impact of Asthma and COPD is large and the affected patients are commonly hospitalized due to poor control and exacerbations (18-21). At the end of the twentieth century, even after the recognition of the growing level of awareness about the disease and its diagnosis, the prevalence and incidence of both increased in many regions of the world. Although clinical studies show that the control of symptoms can be possible, in clinical practice they still poorly controlled and in many countries continues to be a threat to public health (21,22). Inhalation is recommended as the main route of administration of the drug used in treatment of COPD and asthma patients. However, the effectiveness of the inhaled drug can be negatively affected by different factors among these are inhalation technique and type of inhaler used. Insufficiently optimal inhalation technique can have clinical consequences, affecting the effectiveness of treatment and further control of symptoms(23–26). Many factors could contribute to the poor control in these patients, according to the clinical studies, poor technique of inhaler use is a significant factor (17,27). Therefore, clinical guidelines recommended the assessment of inhalation techniques regularly and the correction of the errors in application; hence, there is still a need for research conducted in clinical practice, which would be devoted to assess the effect of correct inhaler technique and the common errors on the control of asthma and COPD (28-30). In this study, 70 patients, 35 with COPD and 35 with Asthma, 60% of the patients had been correctly performing only 3-5 steps, only 17.1% performing correctly 6 steps while only one patient correctly performing the 7 steps. However, a large proportion of the patients had made errors in the essential steps of inhalation technique; this could contribute to the higher rate of poorly controlled asthma and higher frequency of high/very high impact on health in COPD group. Basheti et al.(26) reported 42.9% out of 140 asthmatic patients with poor inhaler technique, had admitted to hospital in the last 12 months. In the current study, there was no significant variation in the education level between COPD and asthmatic group and it has been found that higher level of education and longer duration of use were significantly correlated with higher score of correct use. Similar findings in a previous study by Camilleri et al. (31) confirmed this as they found a positive correlation between the correct use of inhaler and educational level and longer duration of inhaler use. The age and gender distribution of patients in these two groups revealed that COPD patients were significantly older with male predominance than asthmatics. Maricoto et al. (32) found that poor inhaler technique or misuse was significant in patients older than 75 years while in the current study the age has been found not significantly related. Birsen Ocakli et al. (33) found both genders had similarly high errors in inhaler use technique; that agrees with the present study. Regarding the source of teaching of inhaler use, physicians are the main source of teaching with only 11.4% received their teaching about use from pharmacist. Schreiber et al. (34) found that almost 60% of patients received instructions from their doctors, 15% from nursing staff and while 4% from pharmacist. Bosnic-Anticevich et al. (35) and Clarenbach et al. (36) stated that the main source of education about inhaler technique came from specialist doctor while only the little from the pharmacist. This could be attributed to the fact that the vast majority of the patients consult their doctor about the use of the inhaler, and majority of the physicians pay more attention to teach their patients to optimize correct inhaler use and adherence for better control of the disease. Interestingly, Schreiber and Kaplan documented that patients who trained by doctors made more errors compared to those trained by nursing staff or pharmacists which

may reflect that these professions could play an important role in structured patients care and training of inhaler use(34,37). In this study DPI relatively more frequently used than MDI. It is well known that treatment option mainly depend on the clinical evaluation and characteristics of the disease; however, both DPI and MDI are commonly prescribed for inhalation therapy (29). It has been found here that these is no significant differences in the correct steps of inhaler technique between the DPI and MDI users, which disagreed the findings of Gregoriano et al. who reported that incorrect application of device was more frequent with MDI than DPI devices (38). Yet, Luczak-Wozniak et al. found no effect for the type of inhaler on the number of errors in the steps of inhaler technique(39). In the present study, the correlation between the type of inhaler was neither significant in the impact on health nor did the asthma control among the studied group. Similar finding were also reported by Yildiz et al. (24). Coelho et al. demonstrated that a large number of patients made mistakes in using MDI without spacer (40). In the current study, the use of CAT and ACT scoring systems to evaluate COPD and asthmatic patients, respectively. According to CAT score, none of the patients had a low impact on health, more than two thirds of the patients have a high/very high impact on health. Distribution of asthmatic patients according to ACT levels showed that more than two thirds of the patients were poorly or not well controlling their asthma; these findings agreed with what was reported in the previous studies with regard to patients' control of these disease, and could be attributed to poor adherence to treatment and errors in the inhaler techniques applied by the patients. The present findings with this regard are comparable to the previous studies conducted by Guénette et al. (41) and Dürr et al. (42). Another study, conducted by Roche et al., found that 62% of asthmatic patients had good control of their disease and 16% of COPD patients had low

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impact on health. (43) From another point of view, the total ACT score and CAT score, were compared across the correct and incorrect application of each step of inhaler use; these comparisons revealed that patients who correctly applied these steps had a significantly higher ACT total score and significantly lower CAT total score with almost linear correlation. Further, a significant correlation was found between the correct application of inhaler technique steps and lower impact on health. In asthmatic patients, a significant correlation was found between the correct application of inhaler technique steps and good control of asthma. Similar findings were also reported in previous studies: Price et al. showed that patients who correctly applied the steps better control their disease in both children and adult asthmatic patients(44).

CONCLUSION

There is a poor use of the inhaler technique in most of the patients and a positive correlation between the proper use of inhaler and the high educational level of patients and longer duration of use.

RECOMMENDATIONS

- 1. Proper and regular learning of patients and giving instructions about the correct inhalation techniques by physician and other healthcare providers are necessary to obtain optimized treatment and good outcomes. Training of trainers on the ideal and optimal use of all types of inhaler devices is required.
- 2. Educating the patient about the consequences of misusing the inhaler correctly, like failure of treatment and the deterioration the condition, is recommended.
- 3. A new study to enroll the physicians, pharmacists and other healthcare providers about inhaler use technique seems necessary.

CONFLICTS OF INTEREST:

The authors declare no conflict of interest. **REFERENCES**

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