

## Assessment of Inhaler Misuse in Asthmatic Patients

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### Summary:

**Back ground:** Metered dose inhalers (MDIs) are important devices used in treatment of asthma. It has got lots of benefits and some drawbacks depending on usage technique, with proper technique and training the drawbacks can be minimized.

**Objectives:** Estimate the percentage of asthmatic patients using the metered dose inhalers improperly both in technique and dose, and detect the main factors associated with its improper use.

**Patients and methods:** Cross sectional study done from beginning of Jan.-end of May 2013, convenient sampling (150 asthmatic patients) were participated, the questionnaires were filled by direct interview with patients and asking them the steps of inhaler use after take the verbal consent, P-value <0.05 considered statistically significant.

**Results:** From 150 asthmatic patients (34%) of participant can use the inhaler correctly while others were misusing it, all of elderly above 57year, (74.53%) of female gender, (93.33%) of participants who live in rural area, (89.16%) of not employed, and (90%) of low educational level were misusing the inhaler, there was statistically significant association between the use of inhaler and participants who use other drugs to treat asthma rather than inhaler, and those who use steroid inhalers more than two puffs per each time, there was statistically significant association between the use of inhaler and by whom the participants were learned, we found that (65.22%) of participants who learned by specialist were correctly use the inhaler while (34.78%) were misusing it, and (85.71%) of patients who learned by general practional and all of those learned by pharmacist and others like relatives were misuse the inhaler.

**Conclusion:** Two third of asthmatic patients were misusing the inhaler. and the main factors that's associated with misusing of inhaler were; {old age, female gender, not employed, low educational level, use of other drugs to treat asthma rather than inhaler, use steroid inhaler more than two puff in each time of use, and who learned by general doctors and pharmacist or others (relatives)}.

**Key words:** Misuse, inhaler, asthma.

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### Introduction:

Inhalation therapy is one of the important part in the management of asthma(1,2), the important limitation of inhaler devices is that they are more difficult to use and less convenient than tablets, each inhaler device has its own specific sequence of steps for optimal drug delivery and it is therefore necessary to give careful and correct instruction to patients(3), MDI, the most commonly used device, requires the patient to co-ordinate inhalation with action of the device (actuation) which can be difficult for some(4,5). It is important to assess the patient's inhaler technique before establishing a drug regime, according to asthma Guidelines suggested by thorax 2007 assessment of inhaler technique together with treatment compliance and allergen avoidance should

be done before any changes that made to treatment plan(6,7), however, incorrect patient inhaler technique has been identified

as a common and persistent problem by many studies worldwide such as study in Iran 2005(8), Pakistan 2011(9), and Chicago USA 2011(10), up to 90% of adult patients have been reported to have inadequate inhaler technique with higher rates of errors in children and old patients(11), reported prevalence of an incorrect inhalation technique varies from 27 to 89%(12). The high prevalence of incorrect inhaler technique by patients has been explained by several factors; such as that most healthcare providers do not spend sufficient time educating patients on the correct use of the inhalers, some providers themselves have poor inhaler technique thus, they may give incorrect instructions to patients (study in Oman 2001) (13), lack of regular periodic assessment of patients' inhaler technique, any patients have difficulty using their inhalation medication correctly despite the fact that they are taught the technique each time they ask for (14), the type of inhaler is an important determinant of incorrect inhalation such as users of metered-dose inhaler (MDI) make significantly more mistakes than users of other inhalers.(15,16) The present study aimed to estimate the percentage of asthmatic patients using the

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metered dose inhalers improperly both in technique and dose and to detect the main factors that associated with improper use of metered dose inhalers.

#### Patients and Methods:

Cross sectional study. Conducted over the period from beginning of Jan. - end of May 2013, as one day/ week, at: Alzahraa counseling center for allergy and asthma, Almansor primary health care center (PHCC) of family medicine, and Al Emamain kademyian medical city, convenience sampling involved 150 asthmatic patients. Inclusion criteria: Asthmatic patients aged  $\geq 18$  years, on metered-dose inhaler for  $\geq 6$  months.

Exclusion criteria: patients who use spacer, dry powder inhaler and severe ill patients.

Data were collected using a self- administered questionnaire evaluated by three professors of community medicine in two medical colleges (Baghdad and Al-Nahrain) and one senior of internal medicine, depending on direct interviewing (10-15 minutes for each participant).

The questionnaire included: General demographic information: Age, gender, address, Occupation, educational level and marital state, the patient also asked about the onset of asthma and duration of use the inhaler, types of inhaler medication, how many puff use each time per day, and who learned the patient how to use the inhaler.

Likert scale: Scale primarily used in questionnaires to obtain participant's preferences or degree of agreement with a statement or set of statements(17).

Inhaler technique was assessed utilizing detailed checklists 12-steps for MDI, these steps were:

1. Remove the cap of inhaler.
2. Shake the inhaler up and down.
3. Hold the inhaler up right with index figure on the top.
4. Breathe out fully.
5. Hold the inhaler close to your mouth after breathes out fully.
6. Put the mouthpiece in your mouth and close lips around it.
7. Breathe in deeply to full lung with drug no whistle should be heard.
8. Firmly press on the canister at same time of take deep breathing.
9. Hold your breath for 5-10 seconds( with or without inhaler in mouth).
10. Remove the inhaler from mouth before breathing normally.
11. Breathe normally for at least 30-60 second.
12. Repeat the technique for second puff if necessary.

There is no consensus on the most appropriate threshold for defining correct versus incorrect use of respiratory inhalers,

previous studies demonstrate a wide range of definitions for incorrect inhaler technique (i.e. inhaler misuse), from anywhere less than 60% of steps correct to less-than 100% of steps correct(18,19). In the current study, misuse of MDI was defined as <75% of steps correct for use it (< 9 of 12 steps for MDI), our threshold is a conservative mid-point that falls within the broad-range of definitions above, the checklists used in this study were developed based on a review of package-inserts, the published literature. For the assessment of the ability to perform the inhalation technique correctly, the patients were asked to simulate the maneuvers involved in using the inhaler device as the same way of using it at home, saying out loud which step they were performing, so that all of the steps could be observed, to that end we adopted a score based on the number of steps correctly perform.

Statistical Analysis: Descriptive statistics: frequency tables (numbers, and percentages). Analytic statistics: Chi-square test was used to find any association between variables, in two tables we use fischer exact test to increase the validity of Chi-square test. P-value <0.05 considered statistically significant.

Ethical Considerations: After brief explanation of the general purpose of the study and it's objectives, oral consent was obtained from each participant, and permission was obtained from centers were the information gathering from each one.

Limitation of study: There was shortage time to get the data and included larger number of study sample, and there were no many researches similar to this subject.

#### Results:

One hundred and fifty asthmatic patients were included in the study; 106 (70.67%) females, 44 (29.33%) males, their ages range (18-67years), mean ( $37.92 \pm 2.79y$ ), the majority 120(80.00%) lived in urban area, married 97(64.67%), nearly half of participants were unemployed 83(55.33%) and 99(66.00%) with no family history of asthma. The majority of participants 139(92.7%) misuse the step no.8 (firmly press on the canister at same time of taken deep breathing) as shown in figure below:

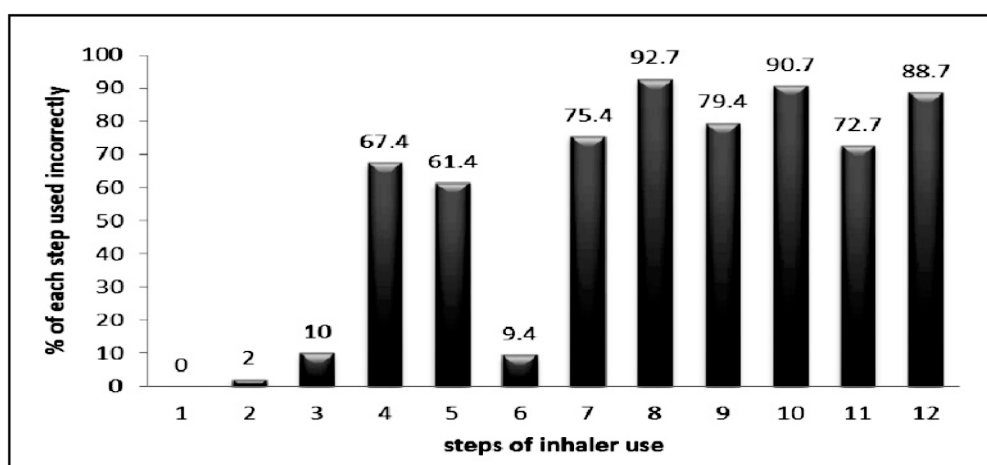


Figure: Distribution of participants according to improper use of inhaler.

There was statistically significant association (p value<0.001) between the use of inhaler and socio-demographic data like {age, gender, address, employment, educational level and marital state}, there was 24(61.54%) adult participants between 18-27 years old use the inhaler in correct way and all of the elderly patients were misusing it, 79(74.53%) of females, 28(93.33%) how lived in rural area, 74(89.16%) of unemployed, 9(90%) of low educational level and married 72(74.23%) were misusing the inhaler.

There was no association between use of inhaler and the types of drugs used in inhaler; but there was statistically significant association between use of inhaler and use other drugs to treat the asthma rather than inhaler like systemic steroid, systemic bronchodilator and oral antihistamine, most of the participants 16(76.19%) who do not use other drugs were correctly use of inhaler, 94(72.87%) of participants who use other drugs were misusing of inhaler. This is shown in table 1:

Table (1): Distribution of study sample according to the types of drugs used inside the inhaler (bronchodilator, steroid, both) and the use of other drugs to treatment of asthma rather than inhaler:

		Correct use		Misuse		Total 150	P-value
		No.(51)	%(34)	No.(99)	%(66)		
Type of inhaler	Bronchodilator	2	40.00	3	60.00	5	0.722
	Steroid	6	42.86	8	57.14	14	
	Both	43	32.82	88	67.18	131	
Other drugs*	Yes	35	27.13	94	72.87	129	<0.001
	No	16	76.19	5	23.81	21	

\*other drugs were (systemic steroid, systemic bronchodilators and oral antihistamine)

There was significant statistical association between the use of steroid inhaler and the dose of inhaler used each time, there was 69(84.15%) of participants used more than two puff per each time were misusing the inhaler, but there was no statistical

association between the use of steroid inhaler and the times of using it per day, also there was no statistical association between the use of steroid inhaler and wash mouth after each use. This is shown in table 2:

Table (2): The relation between use of steroid type of inhaler and dose of inhaler per each time of use, the No. of times of use it per day and washing mouth after each use:

		Correct use		Misuse		Total 145	P-value
		No. (49)	%(34.79)	No. (96)	%(66.21)		
No. of puffs	2 puff	36	57.14	27	42.86	63	<0.001
	>2puff	13	15.85	69	84.15	82	
No. of use per day	2 times	48	34.78	90	65.22	138	0.423*
	>2times	1	14.29	6	85.71	7	
Wash mouth after each use	Almost always	2	33.33	4	66.67	6	<0.001†
	Sometimes	21	80.77	5	19.23	26	
	Rare	19	43.18	25	56.82	44	
	Never	7	10.14	62	89.86	69	

Note: 5 patients do not use steroid inhaler \*Fischer exact test -† Chi-square test is not valid



There was statistical significant association between the use of inhaler and by whom the participants were learned, [specialist, general practitioner, pharmacist or other]. 45(65.22%) of participants who learned by specialist were correctly use the inhaler, and 36(85.71%) of patients who learned by general practitioner were misusing the inhaler, and all patients who learned by pharmacist and others (relatives) were misusing the inhaler. As shown in table 3:

**Table (3): The relation between the use of inhaler and by whom the participant was learned:**

Learned by	Correct use		Misuse		Total	P-value
	No.	%	No.	%		
Specialist	45	65.22	24	34.78	69	<0.001
General doctor	6	14.29	36	85.71	42	
Pharmacist	0	0.00	24	100.00	24	
Other (relative)	0	0.00	15	100.00	15	
<b>Total</b>	<b>51</b>	<b>34.00</b>	<b>99</b>	<b>66.00</b>	<b>150</b>	

#### Discussion:

In our study we found that about one third of studied asthmatic patients were properly use the inhalers (they knew nine steps and more) and two third of them knew less than nine steps from total twelve steps of proper technique, this was approximated to the result of study done in Iraq at 2000(20), the percentage of misuse were (60%) but in other study done in Pakistan at 2011(9), the percentage of misuse were (76%) and other study was done in Brazil 2011, the results was (55%)(21), and in USA at 2011 the percentage of misuse were (45%)(10). The most common steps that mistaken by participants were most of them cannot press firmly on the canister at same time with deeply breathe to full lung with drug (step8) this was less than the results reported by study in Iraq at 2000, but higher than the results reported by study in Iran 2011(8), Oman2011(13), and Italy 2011 (23), not repeat the technique for second puff if necessary (step12) and also most of them cannot do (step9) holds the breath for 5-10 seconds with or without inhaler in mouth this results was higher than the results that reported in study in Iran(8), Oman (13), Pakistan (9), and Italy study (23), and most of patients cannot do (step 7) take deep breathing this was higher than in reported study in Iran, Oman, Pakistan, Italy and USA. This variation in percentage of misuse some steps of inhaler technique associated by many factors related to demographic data of patients and other factors as mention below:

The relation of inhaler use and demographic data: Our study shows a highly significant association between the age and improper use of inhaler. This was the same results reported in

study done in Pakistan (9), Brazil (21), Italy two studies one at 2001(22), the other at 2011(23), and USA (10).

All of participants whose age more than 57 years in our study were misused the inhaler, this can be due to the better efficiency of body and mind in young age, this is supported by the finding that younger patients tend to perform steps such as inhalation, breath holding and exhalation better than older patients, diminishing learning capacity, memory and decrease vision due to increased age are possible attributing factors it is also possible that unmeasured patient confounders such as cognitive status or hearing, among others, play a role in inhaler misuse and ability to learn inhaler technique. There could also be device-specific factors that increase risk for misuse that need to be better evaluated in future studies, therefore, MDI should remain as the preferred method of delivery of medication for young patients. However in the elderly, we may need to consider using the MDI with a spacer device even at the initial stage. In relation to gender of patients we found most of females and less than half of males were misusing the inhaler. This variation between them related to the fact that firstly the number of females in our study was tow third of the study sample. This result was higher than that reported in study conducted in Iraq at 2000 (20), differ from the results of study done in Italy. It is mentioned that was no significant association between the gender and the inhaler misuse(23). There was significant association (p value<0.001) between the use of inhaler and address of participants, in our study we found that most of patients who lived in rural area were misusing the inhaler this may be related to poor educational level and they difficult to learn easily by doctors. In our study we found strong association (p value<0.001) between the uses of inhaler and the employment of patients, there was more than half of students and patients who were employed were misusing the inhaler and more than three quarter of not employed were misusing it, this may be related to that most of not employed patients were females and elderly. Educational level is very important factor that effect on proper use of inhaler, as we found in our study there was strong association (p value<0.001) between the use of inhaler and the educational level of patients, most of highly educated patient (college and above) were use inhaler correctly. And most of low educated patients (illiterate and primary school) were misusing the inhaler because the highly educated patients can easily learned the instruction by their doctors and can read and follow the instruction inside the inhaler pocket. These results were the same of that reported in two studies done in Italy at 2001(22), but disagree with the results that reported in study in Pakistan(9), it noted that there was no association between the use of inhaler and the educational level of patients. In our study we found significant association (p value<0.001) between the use of inhaler and the marital state of participants but there was no any study mention the marital state and its relation to use of inhaler, we



found most of not married (single) patients were correctly use the inhaler and most of married and widow patients were misusing the inhaler. This may related to that all of widow and most of married participants in our study were females and some of them were old age and not employed (housewife) and widow women were in stressful condition that lead to not take care about themselves and cannot take their inhaler in regular dose and frequency and cannot go to hospital or their doctor in regular visits, however we need further studies to support our findings. In This study in table No.1, there was no association between the use of inhaler and the types of drugs inside it, whether the participant use bronchodilator, steroid or both, but there was strong association ( $p$  value $<0.001$ ) with use systemic drugs to treat the asthma rather than inhalers, most of patients who use systemic steroid, bronchodilator, and antihistamine were misusing the inhaler. This may be explained that those participants who didn't use the inhaler in proper way they didn't get any benefit from it use, lead to increase asthma symptoms and difficult to control the disease, therefore; they use other drugs instead to retain to their doctors for checking the way of inhaler use and the dose, these results were the same results of study conducted in Iraq at 2000 (20). In relation to steroid type of inhaler we found in our study there was significant association between the use of inhaler and dose of it per each time of use, Most of participants who use the inhaler more than two puffs per time were misusing the inhaler. This might be attributed that those participants who not use inhaler in correct way didn't get benefit from it therefore they increase the dose of drug by their own or by the doctors instead of recheck the way of use it and learn the patients the correct way of use. And the participants should know that the steroid inhaler should be taken in regular way not on need and most of times in fixed dose two puffs in morning and two puffs in evening except in some patients need to increase the dose more than usual to control the disease (24). In our study there was no association between the inhaler use and frequency of its use per day, and there was no any association between its use and participants wash his mouth after each use or not. In this study there was strong association ( $p$  value $<0.001$ ) between the use of inhaler and by whom the participants were learned, most of them who learned by specialists were use the inhaler correctly. And most of patients who learned by general practional, pharmacists and their relatives were misusing the inhaler, this might be attributed that the specialists are more familiar and experienced in inhaler use than general doctors, pharmacists and others.

#### Conclusion:

Approximately two third of enrolled asthmatic patients were misusing the inhaler device, there were strong statistical association between demographic data [age, gender, employment, and educational level of participants] and inhaler

use, most of participants who use other drugs to treat the asthma like (systemic steroid, systemic bronchodilator and oral antihistamine) and those who use steroid type of inhalers more than the usual dose (i.e. $>2$ puff per time) were misusing the inhaler, participants who learned the correct technique of inhaler use by specialist were more likely to use the inhaler properly, and further researches need to be conducted in Iraq among healthcare providers themselves as well, some of healthcare providers responsible for instructing patients on the correct MDI technique were unable to perform this technique correctly indicating the need for regular formal training programs on inhaler techniques

#### Author contributor:

suha: data collection and interpretation, study design.

Amar: data interpretation, study design.

Wasan: data interpretation, study design.

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