

Knowledge and Practice of Metered-Dose Inhalers (MDIs) Among Asthmatic Patient in Al-Shaab Hospital In Khartoum 2018

Heber Ahmed Omer Mohamed^{1*}, Mohammed Hammad Jaber², Abrar Nader Aljaili Mohamed Hussein¹, Asia Abd Elnasir Mohamed Hessin¹, Mahmoud Mahamed Abd Allah Mohamed¹ and Cathrine Victor Gabra¹

¹Faculty of medicine , Nile college ,Khartoum Sudan

*Corresponding Author

Heber Ahmed Omer Mohamed, Faculty of medicine , Nile college ,Khartoum Sudan.

²Faculty of medicine , Alzaiem Alzhari University , Khartoum, Sudan

Submitted: 2023, Nov 08 ; Accepted: 2023, Dec 04; Published: 2024, Feb 23

Citation: Mohamed, H. A. O., Jaber, M. H., Hussein, A. N. A. M., Hessin, A. B. E. M., Gabra, C. et al. (2024). Knowledge and Practice of Metered-Dose Inhalers (MDIs) Among Asthmatic Patients in Al-Shaab Hospital in Khartoum 2018. *J biotech bioinform*, 1(1), 01-08.

Abstract

Inhalation therapy has proven to be the best way to control asthma, currently metered-dose inhaler (MDI) is widely prescribed, but many patients with asthma use their inhaler device incorrectly. While the MDI play an important role in asthma control, yet the incorrect inhalation technique lead to deterioration of asthma and other unnecessary sequences. There are many variables related to the incorrect inhaler technique, knowing these factors help to correct the patient's inhaler technique and affect directly toward asthma control. The aim of this study was to assess the knowledge and practice of metered-dose inhaler among asthmatic patients in Al-Shaab Hospital in Khartoum-sudan.

This is observational descriptive cross-sectional study. Data has been collected from 70 asthmatics patients using a questionnaire filled by the researcher and an inhaler specific check-list for the observation of patient's inhaler technique. This study results contain 26 (37.1%) male and 44 (62.6%) female, 57.1% of patient's performed poor inhaler technique, and inhaler technique was not significantly related to asthma severity ($p=0.158$). The mild grade of asthma severity was the dominant by 52.9% of patients. Most patients didn't have other diseases (50%) and the most common other disease was sinusitis (18.6%). Most of patients (38.6%) don't use other medications beside the Ventolin® (Salbutamol) inhaler, but 24.3% of those who use other medication use Symbicort® (budesonide/formetrol) or other inhalers. The majority of patients 37.1% and 34.3% had their asthma diagnosed since more than 10 years and had been using MDI since more than 10 years respectively. For the technique self-evaluation almost half (51.4%) of patients evaluated them self as very good and the rest as good. 88.6% said that they relieve from symptoms after using the inhaler.

Most of patients (55.7%) had their information in how to use the inhaler from respiratory specialist, and almost half of patient's (51.4%) said that their inhaler technique had been observed by doctor or pharmacist. 52.9% of patients use the inhaler twice or less per week. The correlation between patient's occupation and inhaler technique was significantly related ($p=0.054$).

Most of patients had good knowledge about the inhaler. However, the majority use their inhaler incorrectly, and the only factor that effect on inhaler technique with significant correlation was found to be the occupation. And we still recommend on ensuring the patient's inhaler technique at each visit, despite the asthma severity.

1. Background

Asthma is one of the most common chronic respiratory diseases especially through the last 4 decades, worldwide in developed and developing countries, from all ages and particularly children. Asthma defined as a respiratory condition marked by spasms and increase in the mucus production in the bronchi of the lungs, causing symptoms as coughing, wheezing and breathlessness (difficulty in breathing). It usually results from an allergic reaction

or other forms of hypersensitivity with severity varying from person to person [1].

Asthma is a chronic condition for which there is no cure; but it can be often be effectively managed [2]. For a medication to work it has to be taken effectively by the patient. This sounds obvious, but for practitioners prescribing inhalers it is not as simple as writing out a prescription [3]. Evidence shows that many patients continue

to suffer symptoms unnecessarily and that poor inhaler use and compliance is one of the main reasons for this. Particularly in countries where the number of patients per physician is relatively high, incorrect or false use is very common among the patients since they are not given sufficient training, if any, on the use of inhaler devices [4].

The first line in controlling asthma are the inhalers, which contain many types, this include metered-dose inhalers (MDIs), MDIs with a spacer (useful for children and people with asthma who lack the coordination skills to use the metered-dose inhaler correctly) which gives more time to inhale the drug, and dry- powder inhalers (also known as breath-activated inhalers [5].

According to deaths registered in England and Wales In 2014, the National Review of Asthma Deaths (NRAD) reported that misunderstanding and misuse of inhalers was thought to have contributed to a significant number of the 195 asthma deaths during 2012. According to the NRAD report, only 49% of patients reviewed in primary care had their inhaler technique checked in the year before their death. Furthermore, 17% of patients admitted to hospital (n=83) did not have documented evidence that their inhaler technique had been checked during their admission [6].

The rate of incorrect use is higher for MDI devices, since they require more patient coordination and cognitive function. In several wide-scale studies, the rate of incorrect use has been reported to be 32–96% for MDIs [7]. The most common errors are failing to inhale during spraying and failing to hold the breath. Incorrect use of inhalation drug delivery devices has been reported in the range 46% to 59% – that's half of these patients having critical errors in their inhaler use, which means that they are not receiving the dose of medicine prescribed or often, none [8].

Studies evaluating the parameters that affect the incorrect use of inhaler devices have reported different results. There are studies demonstrating that age and gender has no impact on the ability to use the devices. Whereas, there are studies showing that the success declines with aging, and women or men, are more successful. Similarly, the level of education seems to be a factor affecting ability, whereas its effect has been reported to be insignificant in some studies. The impact of the type of disease, asthma or COPD, has also been explored and no significant difference was shown [9]. The technique of using the inhaler device must be described to the patients. The patients learning the technique via the prospectus or brochure have a very low rate of success. There is a wealth of evidence that misuse of inhalers is associated with decreased disease control [10].

It's important to use the inhaler correctly, incorrect inhaler technique can result in poor treatment outcomes for people with asthma. Several studies have reported decreased bronchodilator response in patients not using their inhaler correctly [11].

Errors can lead to poor compliance, treatment failure,

exacerbations, unnecessary medical interventions and escalation of therapy. It's also associated with asthma instability, increased hospital visits, and increased short-acting B2-agonist use which can result in unnecessary side effects. Correct inhaler technique is essential to maximise the benefits of available treatments and improve treatment outcomes [12].

Healthcare professionals (HCPs) play a vital role in helping patients use their inhalers effectively. However, guidance on correct technique is often based on local habits, with limited clinical evidence, and many clinicians are unable to demonstrate correct inhaler technique [13]. Yet it's important for the patient to counsel physician or pharmacist about the inhaler technique to optimizing their technique therefore to maximize the benefits of these medications and improve outcomes for the patient, the goal of asthma treatment is for patients to be symptom free and to be able to lead a normal, active life [14]. Other studies show that's very important for correct use that such training is given by the prescribing chest diseases specialist rather than the nurse or family physician. Several studies performed on the healthcare professionals showed that the ability to use the inhaler devices is very low in nurses, family physicians, pharmacists-pharmacy technicians and interns, and some studies suggested that the rate of misuse among these professionals are even higher than the rate in patients [15].

The most common metered-dose inhalers are the brown inhaler is also known as reliever inhaler (for prevention) and the blue inhaler (for attacks of asthma and/or prevention), which are types of MDIs. Inhalers are used to deliver low doses of medication into the airways both to relieve symptoms and prevent further attacks. Blue inhaler is used for immediate rescue when the patient experiencing symptoms, such as chest tightness or shortness of breath. It contains a short acting bronchodilator known as Salbutamol, and it's most common brand is Ventolin® (Salbutamol); which quickly opens the airways during an asthma attack. The drug acts to relax the muscles around the airways, allowing them to open up and make it easier to breathe for instant relief of symptoms. Everyone with asthma should have a blue inhaler as it's needed to treat asthma attacks. The brown inhaler is used to help manage symptoms and help prevent further attacks. In contrast to the blue inhaler, this is not a rescue medicine, it contain a low dose of steroids that help reduce the sensitivity of airways, and used regularly to decrease the attacks by building resistance to triggers. There are also other colours of MDIs like red, purple, green and other colours of inhalers some of which contain reliever or preventer medicines, either in combination or as single preparation [16]. We conducted this study to assess the knowledge and practice of metered-dose inhalers (MDIs) among asthmatic patient in Al-Shaap Hospital on NOV 2017_ FEB 2018.

2. Methodology

2.1 Study Design: Observational descriptive Cross-sectional study.

2.2 Study Population: The study was conducted on asthmatic

patients admitted, attended or referred to Al-Shaab Hospital.

Included if they:-

- Had a medical diagnosis of asthma by a physician.
- Currently using metered dose inhaler device.
- Patients of both genders in the age group were above 5 years old.

Excluded if:-

- Patients going through severe asthma attack, unless they relieve, the criteria for excluding the patients include the following symptoms: breathlessness, wheezing and coughing.

2.3 Study Area:

The study was conducted at Al-shaab Hospital at Al-khartoum st. Al-saied Abdull-rahman. It's a public hospital was established at 1904, the hospital is the first referral and educational hospital in Sudan, it offer health services for referred patients from all the states for simple and major surgeries and all types of emergencies for free or nominal price. The hospital receive large number of patients daily, at different departments of different specialties, and the study will be conducted at the pulmonary medicine department.

2.4 Sample Size:

This study included the whole population which was the asthmatic patient attending to Al-Shaab Hospital during 2 weeks, roughly about 70-100 patients. The sample size for these studies was 70 patients.

2.5 Sampling Technique:

Because the population size can't be determined, beside there is no available population list that can be used to select the samples. So according to the previous criteria the sampling technique that was used is total coverage.

2.6 Study Variables:

Dependant:

- 1- Source of knowledge of how to use the inhaler.
- 2- The steps of inhaler technique usage.

Independent:

- 1- Educational/reading level.
- 2- Age.
- 3- Gender.
- 4- Residence.
- 5- Social status.
- 6- Occupation.
- 7- Having other disease.
- 8- Using other medications.
- 9- Follow up (inhaler technique had been observed by a doctor or pharmacist).

2.7 Data Management:

2.7.1 Data Collection

The study was conducted with patients having bronchial asthma. After obtaining clearance from the MOH Ethics Committee and Al-Shaab medical director, the study was carried out from December

2017 to February 2018 in the Department of Pulmonary Medicine in Al-Shaab Hospital. A verbal informed consent was taken, and patients were enrolled in the study as per the inclusion criteria.

Data were collected using check list and questionnaire filled by the investigator (interview), the investigator assessed inhaler technique using specific checklist that contain 7 steps [30], where each patient demonstrated their inhalation technique using the blue inhaler (salbutamol) or placebo for patients who are more susceptible to salbutamol side effects (e.g. hypertensive & cardiac patient). Making more than 2 wrong steps was considered as poor technique, while making 2 or fewer wrong steps was considered as good technique, based on a study done in Brazil 2014, where making more than 2 wrong steps is significantly related to asthma severity [25].

The asthma severity was assessed by questions for asthma classification by GINA guidelines which contain the frequency of day & night symptoms, the symptoms effect on daily activity and the frequency of flare-up (frequency of using the inhaler)[31]. The asthma severity was determined by the investigator right after the asthma severity questions, where the frequency of nocturnal symptoms and the effect on daily activity are the main determinate for the severity if the patient choose different choices related to different types of severity.

And according to the previous criteria the asthma severity is divided to 4 grades (intermittent, mild, moderate, and sever): inhaler. Also the questionnaire contained demographic data (age, gender, residence, educational level, occupation and social status), other diseases, other drugs, the duration since diagnosed and using the inhaler, self-evaluation for the technique (poor= 1-3 from 10, good= 4-6 from 10 and very good= 7-10 from 10), the patient's source of information in how to use the inhaler, follow up of technique by doctor or pharmacist, satisfaction about the inhaler outcome and questions that determine asthma severity according to GINA [31]. All colours (types) of MDIs had the same using technique, so the blue inhaler was used in this study for the observations, as being the most type used of MDI, and the spacer was not included during observation.

2.7.2 Data Analysis:

The data were analyzed using Statistical Package for Social Science (SPSS version 2009) data analysis. And presented by comparing the findings in dependent text, pie chart for composition of the population, bar charts for comparison and tables for demographic data and comparing the technique with the variables.

2.8 Ethical Consideration:

The research had been approved by Al-Shaab medical director. The research follow human rights and principles of research ethics which are autonomy, beneficence, non-maleficance and justice, each of the principles was represented in a certain form. The informed consent is main presentation for the previous principles,

and it work with both side with the participant by protecting his/her rights and with the researcher by allowing him/her to utilize the participant information even if the patient decided to withdraw. Autonomy in the right of the patient to freely choose to participate or not, or to withdraw from the research at any time after the researcher explain enough to the patient about the research and his/her rights, and preserve the rights of minors and mentally disabled people by letting the custodian to approve the final decision, to ensure confidentiality by committing to limiting the access to the patient information only to the researchers and the research committee, beneficence by conducting the research on public hospital to let the community get the benefit from the research results and correcting the errors of the inhaler usage technique, non-maleficence by minimizing the risk of harm by letting the patients with diseases that are more susceptible to salbutamol side

effects like hypertension to use placebo, and also the disclosure of the minimal side effects to other non-susceptible patients, justice by using fair non-probability methods for selecting the research participants.

The approval to the informed consent was obtained verbally from the research participants, after taking the permission of the research health committee on the informed consent and the research from the ethical point of view, it's better to obtain verbal approval from the research participant due to the following reasons: there may be an illiterate participant in the research, the personal information of the research participant will be anonymous, and the study involve minimal risk factors.

3. Results

		Frequency	Percent
Gender	Male	26	37.1
	Female	44	62.9
Age	5 - 18	5	7.1
	19 - 30	42	60.0
	31 - 60	14	20.0
	Above 60	9	12.9
Occupation	Student	30	42.9
	Freelancer	14	20.0
	house wife	18	25.7
	Professional	6	8.6
	Retired	2	2.9
Level of education	Illiterate	3	4.3
	Elementary School	10	14.3
	Secondary School	17	24.3
	University	31	44.3
	Higher Education	9	12.9
Residence	Khartoum	43	61.4
	Bahri	10	14.3
	Omdurman	13	18.6
	Out Of Khartoum	4	5.7
Social status	Married	25	35.7
	Single	41	58.6
	Divorced	2	2.9
	Widowed	2	2.9
	Total	70	100.0
	Total	70	100.0

Table 1: the socio-demographic data of the population:

- The analysis above shows that 10% of study sample have hypertension, 8.6% have diabetes, 1.4% have heart disease, 18.6% have sinusitis, 1.4% have chronic bronchitis, 10% other diseases, 50% with no any disease.
- The analysis shows that 24.3% of the study sample using symbicort or other inhalers, 12.9% using cortisone, 7.1% using hypertension medications, 10% using diabetes medication, 7.1% using other medications, 38.6% not using any medication.
- The analysis shows that 5.7% of study sample being diagnosed since less than 6 months, 8.6% being diagnosed between 6 months to 1 year ago, 28.6% diagnosed between 1 to 5 years ago, 20 % diagnosed between 5 to 10 years ago, 37.1% diagnosed 10 years ago.
- the analysis shows 8.6% of study sample started using the inhaler for less than 6 months, 7.1% started using the inhaler between 6 months to 1 year, 31.4% started using inhaler between 1 to 5 year/s, 18.6% started using the inhaler between 5 to 10 years, 34.3% started using inhaler for more than 10 years which are the majority of study sample.

Analysis shows that no one from the study sample had poor self-evaluation technique, 48.6% of patients had good self- evaluation technique and 51.4% are very good.

The analysis shows the 88.6% of study sample said yes (relieve after using the inhaler) and 10% said no (don't relive after using the inhaler). The analysis shows that 8.6% of study sample get their knowledge through leaflet, 55.7% from respiratory physician, 7.1% from GP, 11.4% from pharmacist, 11.4% from member of family, 5.7% from friend. Most patients got their inhaler technique information from respiratory physician. The analysis shows that 51.4% of population study said yes and 48.6% of patient said no to being observed by a doctor or pharmacist while using the inhaler. Analysis shows that 52.9% of study sample are using the inhaler more than 2 times per week, 27.1% using the inhaler less 2 times per week, 20% using the inhaler daily. The majority are using the inhaler more than 2 times per week. Analysis shows that 52.9% of study sample have intermittent asthma, 28.6 % mild asthma, 17.1 % moderate asthma, and 1 % severe asthma. The majority are intermittent asthma. Analysis shows 57.1% of study sample are using the inhaler in poor technique, while 42.9% are using the inhaler in good technique. The majority are using the inhaler in poor technique.

4. Discussion

Inadequate inhaler technique is an obvious problem that can negatively affect the asthma control, at the present study poor (incorrect) inhaler technique was found to be the dominant by 57.1% of patients, in compare to a study done in Nigeria which the result was 79.8% of patients showed incorrect technique while using metered-dose inhaler [26], but unlike study done in Brazil show that only 30.2% of patients have poor inhaler technique [25]. Despite that most of patient's use their inhaler incorrectly, 88.6% of patients said that they relieve from symptoms of asthma after using the inhaler.

Knowledge is the first step toward good inhaler technique performance by the patient, to know the benefit of using the inhaler correctly to the control of asthma symptoms and the right inhaler technique steps ease the path for the patient and the health worker during training for the inhaler technique. The patient's source of knowledge in how to use the inhaler is very important in determining the quality of patient's knowledge especially if the source is from chest specialist. The patients learning the technique via the prospectus or brochure have a very low rate of success [10]. In the current study the patients reveal good knowledge about the benefit of correct inhaler use, in which that all the participants (n=70) with 100% agreed that the correct inhaler technique as showed in the inhaler check list is related to well controlled disease. 55.7% of patients got their knowledge in how to use the inhaler from chest specialist, and this support more about the patient's knowledge is good despite their inhaler technique. Unlike a study in Bangladesh show that only 17% of asthma patient could had the basic knowledge on inhaler technique properly [18]. Another study in Bangladesh shows that 69.6% of bronchial asthma patients are lacking the knowledge of correct use of inhaler [19]. A similar study done in Pakistan state that 24.0% of asthmatic patients had poor knowledge on inhaler use [20].

Regard the relation between the source of knowledge in how to use the inhaler and the patient's inhaler technique ($p=0.954$) there was no significant correlation, which mean that source of knowledge don't have a noticeable impact on the inhaler technique in this study. A study in Pakistan state that the rate of correct use was higher with patients have been trained by chest diseases specialist [24]. Conversely, other study state that the rate of correct use is very low among patients who got their knowledge and training by pharmacists in compare to those who had their knowledge and training by a chest specialist [27].

This study evaluated the relationship between the patient perception (self-evaluation) for his/her own technique and the patient's actual inhaler technique, which is another determinant for patient's knowledge, as many patients may think that their technique is good enough but in-fact it's poor technique. This study shows that most of patients evaluated their technique as very good (51.4%), and no patient evaluated his/her technique as poor at all, while most of patients actually had performed poor inhaler technique (57.1%). With no significant correlation ($p=0.490$) between the self-evaluation and inhaler technique. A study done in USA shows that the mean percentage of agreement of patient's self-report with observations is 77%, which means that most patients evaluated their technique correctly if it's poor or good [32].

There is strong connection between inhaler technique and asthma severity, the patient's inhaler technique is considered to be good if it's related with intermittent or mild asthma grade [28]. Wrong inhaler technique can substantially reduce lung deposition of the drug, undermining the effectiveness of asthma treatment, in turn lead to deteriorate of the asthma severity into the sever form.

As not expected this study determined the correlation between inhaler technique and asthma severity as not significant with value $p=0.158$, at variance with most other studies show that there is significant correlation between inhaler technique and asthma severity, like the study done in Spain state that the 30.2% poor inhaler technique was associated with poor asthma control ($p=0.002$)[25], also another study done in Nigeria explain that patient with less severe asthma are more likely to use the inhaler correctly($p<0.01$)[26]. A study in Barcelona state that patients with more episodes of exacerbations of disease are more likely to have poor inhaler technique ($p<0.001$) [29]. Inhaler technique was related to many factors in this study, this study included most of factors which are demographic data (age, gender, social status, residence, educational level and occupation), follow up (inhaler technique had been observed by a doctor or pharmacist), source of knowledge, having other diseases and using other medications. While occupation where found to be the only factor that affect patient's inhaler technique in this study. The previous factors are believed to affect the patient's inhaler technique, as each factor a specific range may lead to poor inhaler technique, thus result in uncontrolled (severe) asthma. Another study done in Pakistan also correlate the inhaler technique with patient's demographic data [24]. A study done in Brazil state the parameters for wrong inhaler technique which are having other conditions (diseases), age, occupation (type of job), level of education, and observation of technique by a professional (chest specialist) [25]. In Spain there is study shows other factors like adequate supervised instruction [24]. And the study done Nigeria reveal factors like educational level, the frequency of symptoms and the being trained in how to use the inhaler by a doctor or pharmacist [26].

The results show that the majority of patients had been diagnosed with asthma since 5 to 10 years ago, while also the majority of patients have been using the device since more than 10 years, this time gap between diagnosis and using the inhaler have a critical effect on inhaler technique, as those who used the inhaler before the diagnosis have a higher rate of performing incorrect inhaler technique, because their inhaler technique may not be checked by any professional health worker.

There are studies showing that the success in using the inhaler correctly declines with aging (aged 50 years or above) Amsterdam [33]. Age factor had no significant correlation to the inhaler technique ($p=0.249$) in this study, just like a study done in Spain [22]. Other study done in Pakistan state that age was a significant parameter to the inhaler technique [24], Other studies show that the ability to use the inhaler is better among male than female [24]. This might be related to the sociocultural structure of the region where the study was performed. It might be expected for women to have a lower rate of success in a population involving women who are rather limited to the house, are not employed, and do not have social interactions due to ethnic and religious reasons. Like a study done in Spain [22], the current study show no significant correlation between patient's gender and inhaler technique with $p=0.428$.

The social status may affect the inhaler technique, as a study done in Brazil found out that inappropriate inhaler technique is more common in widowed patients [25]. As being single, married, divorced or widowed can contribute to a varying degree of social interaction (e.g. isolation and loneliness) that can negatively impact the treatment of chronic disease. This study result exhibit no significant correlation between the patient's social status and inhaler technique ($p=0.104$). Living in big cities or the capital ease different types of services, as living outside the capital may be a little difficult to reach for experts who can give the right instructions in how to use the inhaler, other study done in Turkey prove this fact, show that patients living in cities were more correctly using the devices [27]. The present study show no significant correlation between residence and inhaler technique ($p=0.203$).

Education is one of the most important parameters at many aspects of health, nevertheless this study result state that there is no significant ($p=0.126$) correlation between educational level and inhaler technique. A study done in Turkey show that there is significant between educational level and inhaler technique, where the rate of incorrect technique was higher among patients with no education or those who were literate [27]. And another study done in Nigeria also state that patients with higher educational qualification are more likely to use MDI better [26]. Occupation have strong impact on respiratory disease in general, the work environment (cold, dust and smoke) that can negatively affect asthma, but principally in this study the relation is between the inhaler technique and occupation as it may have an important role in the way of thinking and taking care of the inhaler technique. The result show significant correlation between inhaler technique and occupation, but as not expected the result tell that most of the good inhaler technique was conducted by students (17), followed by freelancer, house wife and professional. Also the poor technique was done mostly buy housewife (15) followed by student, freelancer, professional and retired.

Follow as being observed for the technique by a doctor or pharmacist at least once, assess the patient to correct his/her inhaler technique, thus guide to good asthma control. Most other study show that the training and follow up with patient significantly impact the inhaler technique [27]. In a study done in Pakistan the correct use significantly increase among those being followed up than those who not [24]. The present study appear no significant correlation between inhaler technique and being observed for the technique by a doctor or pharmacist at least once ($p=0.303$).

Having other disease or using other medication could negatively impact the inhaler technique, because it can distract the patient's attention regard the inhaler technique, in a study done in Brazil having other disease was associated with inappropriate inhaler technique [25]. But the current study show no correlation between the inhaler technique and each of the following diseases: hypertension, diabetes, heart disease chronic bronchitis, sinusitis or others, ($p=0.494$). And no correlation with each of the following medications: Symbicort inhaler or others, cortisone (allergy

pills), hypertension medications, diabetes medications or others, (p=0.999).

The present study has some limitation to consider. First, it was cross-sectional and, it doesn't allow the establishment of a temporal sequence between the quality of the patient's performance of inhaler technique and their level of asthma control. Secondly the study was carried out at a single hospital.

5. Conclusion

Most of asthma patients have relatively good knowledge in how to use the inhaler and the benefit of that, despite that the majority of them use their inhalers incorrectly (poor practice). Unexpectedly the asthma severity was not proven to be related with the inhaler technique.

We are aware that the finding a relationship poor inhaler technique and the expected factors would not absolutely improve inhaler technique if the factors had been modified. However, the results of this study demonstrate the most important factor was the occupation of the patient. Other factors which were not significant in this study included demographic data, being observed by a doctor or pharmacist, source of knowledge in how to use the inhaler, duration since of diagnose and duration of using the inhaler, having other diseases, and using other medications.

Recommendations

Patients who can use MDIs correctly have better asthma control. The inhaler usage technique should be re-assessed and modified in management guidelines in Sudan to assure that the medical staff is able to deliver the correct inhaler technique to the asthmatic patients. Practitioners must check that patients have mastered the correct use of their inhaler prior to their first prescription. The patient's inhaler technique needs to be re-checked at each periodic disease review, especially if there is poor symptom control and regardless of the patient's educational level.

References

1. Murphy A. Asthma: the condition and its diagnosis. *Clinical Pharmacist*. UK 2010; 2:203.
2. National Heart, Lung, and Blood Institute, National Institutes of Health. National Asthma Education and Prevention Program. Expert Panel Report 3: Guidelines for the diagnosis and management of asthma. NIH Publication No. 07-4051. 2017.
3. American Academy of Allergy and Asthma AAAA. 2018.
4. Levy ML, et al. Inhaler technique: facts and fantasies. A view from the Aerosol Drug Management Improvement Team (ADMIT). *NPJ Prim Care Respir Med*, London, UK. 2016; 26:10617.
5. National Asthma Council Australia's Inhaler technique in adults with asthma or COPD information paper.2018.
6. Melani, A.S., Bonavia, M., Cilenti, V., Cinti and Gruppo. Educazionale Associazione Italiana Pneumologi Ospedaliери. Inhaler mishandling remains common in real life and is associated with reduced disease control. *Respir Med, Siena, Italy*. 2011; 105: 930-938.
7. Bartolo K, et al. Predictors of correct technique in patients using pressurized metered dose inhalers. *BMC Pulm Med* 2017; 17:47.
8. Khassawneh, B.Y., Al-Ali, M.K and Alnasr, H.M. Handling of inhaler devices in actual pulmonary practice: metered-dose inhaler versus dry powder inhalers. *Respir Care, Jordan*. 2008; 53: 324-328.
9. Mirici, A., Meral, M., Akgün, M., Sağlam, L. and İnandı, T. Factors effecting patients compliance to inhalation techniques. *Solunum Hast*. 2001; 12: 13-21.
10. Price, D., Bosnic-Anticevich, S., Briggs, A., Chrystyn, H. and Bousquet, J. Inhaler competence in asthma: common errors, barriers to use and recommended solutions. *Respir Med. Inhaler Error Steering Committee, University of Aberdeen, UK*. 2013; 107: 37-46.
11. Liard, R., Zureik, M., Aubier, M., Korobaef, M., Henry, C., and Neukirch, F. Misuse of pressurized metered dose inhalers by asthmatic patients treated in French private practice. *Rev Epidemiol Sante Publique, Paris, France*. 1995;43: 242-249.
12. Rootmensen, G.N., vanKeimpema, A.R., Jansen, H.M., and de Haan, R.J. Predictors of incorrect inhalation technique in patients with asthma or COPD. *J Aerosol Med Pulm Drug Deliv, Amsterdam*. 2010; 23: 323-328.
13. Lee-Wong, M. and Mayo, P.H. Results of a programme to improve house staff use of metered dose inhalers and spacers. *Postgrad Med J. New York, USA*. 2003; 79: 221- 225.
14. Plaza, V. and Sanchis, J. Medical personnel and patient skill in the use of metered dose inhalers: a multicentric study. CESEA Group. *Respiration. Spain* 1998; 65: 195-198.
15. Hanania, N.A., Wittman, R., Kesten, S., and Chapman, K.R. Medical personnel's knowledge of and ability to use inhaling devices. Metered-dose inhalers, spacing chambers, and breath-actuated dry powder inhalers. *Chest. Toronto, Canada*. 1994; 105: 111-116.
16. Evaluation of inhaler devices usage techniques 2016. Price D, Bosnic-Anticevich S, Briggs A, Chrystyn H, Rand C, Scheuch G, Bousquet J. Inhaler competence in asthma: common errors, barriers to use and recommended solutions. 2013 Jan.
17. Chowdhury MAJ, Rafiquddin AKM, Hussain A. Salbutamol inhaler what the patients know? *Bangladesh Journal of Medicine*. 1998; 3(1): 1-3.
18. Akter M. knowledge and practice about prevention and control measure of asthma among the asthma patients in a selected asthma center, Dhaka, Department of HP & HE, NIPSOM; 2002
19. Parvin IA, Ahmed SA, Islam MN. Knowledge about inhaler use among the chronic asthma patients in selected hospital. Pakistan, 2011; 37:47-50.
20. Larsen JS, et al. Evaluation of conventional press-and- breathe metered-dose inhaler technique in 501 patients. *Minneapolis, Minnespta, USA*, 2007; 31(3):193-9
21. Golpe Gómez R, Mateos Colino A, Soto Franco I. inadequate technique in the use of inhalers in patients seen at a pneumology

-
- clinic, Hospital Comarcal de Monforte de Lemos, Lugo, Spain, 2001 Feb;18(2):69-73.
22. Hesselink AE, Penninx BW, Wijnhoven HA, Kriegsman DM, van Eijk JT. Determinants of an incorrect inhalation technique in patients with asthma or COPD. *Amsterdam, Germany*, 2001 Dec; 19(4):255-60.
 23. Farooq MZ, Farooq MS, Waqar W, Mustaqeem M, Khan JA, Saadullah. Assessment of inhalation technique among patients of chronic respiratory disorders in Civil Hospital Karachi: A cross sectional study. *Aga Khan University, Karachi, Pakistan*. 2016 Nov; 66(11):1502.
 24. Onyedum C, Desalu O, Nwosu N, Chukwuka C, Ukwaja K, Ezeudo C. Evaluation of inhaler techniques among asthma patients seen in Nigeria: an observational cross sectional study. *Nigeria*, 2014 Jan;4(1):67-73
 25. Aydemir Y. Assessment of the factors affecting the failure to use inhaler devices before and after training. *Department of Pulmonology, Sakarya, Turkey*. 2015 Apr; 109(4):451-8.
 26. Levy ML, Hardwell A, McKnight E, Holmes J. Asthma patients' inability to use a pressurised metered-dose inhaler (pMDI) correctly correlates with poor asthma control as defined by the global initiative for asthma (GINA) strategy: a retrospective analysis. *University of Edinburgh, Edinburgh, UK*. 2013 Dec; 22(4):406-11.
 27. Darba J, Ramirez G, and Garcia Bujalance L. ed. Dr Haiyan Qu Identification of factors involved in medication compliance: incorrect inhaler technique of asthma treatment leads to poor compliance. *Universitat de Barcelona*. Feb 2016. Volume 2016:10, page135-145.
 28. Paulo de Tarso, Denis Maltz Grutcki and Paola Panganella Laporte. Factors related to the incorrect use of inhaler by asthma patients. *Brazil*. Jan-Feb 2014; 40(1)13-20.
 29. GINA Classification of Asthma Severity. 2016.
 30. Erickson SR, Horton A, Kirking DM. Assessing metered-dose inhaler technique: comparison of observation vs. patient self-report. *USA*. 1998.
 31. Van Beerendonk, I., Mesters, I., Mudde, A.N., and Tan, T.D. Assessment of the inhalation technique in outpatients with asthma or chronic obstructive pulmonary disease using a metered-dose inhaler or dry powder device. *J Asthma*. Maastricht University, Amsterdam, Germany 1998; 35: 273–279.

Copyright: ©2024 Heber Ahmed Omer Mohamed, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.