

IMPACT OF PROPER METERED DOSE INHALER TECHNIQUE OVER PEAK EXPIRATORY FLOW RATE IN MODERATE PERSISTENT BRONCHIAL ASTHMA

Muhammad Hammad Athar, Usama Bin Zubair*, Barik Hassan Ahmed**

Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan, *Pakistan Institute of Medical Sciences Islamabad Pakistan, **Princess Royal University Hospital United Kingdom

ABSTRACT

Objective: To determine the impact of proper metered dose inhaler technique over peak expiratory flow rate (PEFR) among the patients of moderate persistent bronchial asthma.

Study Design: Randomized controlled trial.

Place and Duration of Study: Military Hospital Rawalpindi, Six months, from Dec 2017 to Jun 2018.

Material and Methods: The sample population comprised of patients suffering from moderate persistent bronchial asthma presenting in medical outpatient department. Patients were divided into two groups. Patients in group A were not educated regarding proper technique for using metered dose inhaler and used the faulty technique. Patients in group B were educated regarding proper technique for using metered dose inhaler. Peak expiratory flow rate was determined via standard peak expiratory flow rate device in both the groups after the inhalation of standard dose of salbutamol. Mean PEFR was calculated and compared for both the groups.

Results: The mean peak expiratory flow rate score of patients without the education of proper technique was 320 ± 9.28 whereas mean PEFR score in patients after the proper metered dose inhaler technique was 460 ± 6.66 (p -value <0.001). The PEFR scores after the use of metered dose inhalers with proper technique were significantly higher than those without the use of proper technique.

Conclusion: This study showed that proper use of metered dose inhaler device has a significant impact on the peak expiratory flow rate. Proper time should be given by the physician or pharmacist to explain the patient regarding proper use of this device in order to ensure its optimal functioning.

Keywords: Asthma, Metered dose inhaler, PEFR.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Bronchial Asthma is a chronic inflammatory airway disease which is characterized by wheezing, chest tightness, recurrent bouts of shortness of breath and cough in response to stimuli such as exercise, seasonal changes, allergens, occupational irritants, stress and drugs. Over 300 million people are affected with this disease worldwide, with prevalence increase of 50% for every 10 years^{1,2}. Poor control of asthma remain a major cause of emergency presentation and admission in the hospital³. Uncontrolled asthma has been posing a major burden over budget in the health care department even in the developed countries. Almost one-third of all asthma budget is consumed on emergency

presentations of the patients in the united states⁴. Asthma patients report commonly in the accident and emergency department of the hospital due to the acute exacerbations. Most common reported factors for these emergency department visits of bronchial asthma patients include inappropriate inhaler technique, disease severity and poor compliance⁵. It is one of the major public health problems which has a negative effect on patients and their surrounding by causing work loss, frequent hospitalizations, compromised quality of life and eventually death⁶.

Management of asthma involves a lot of factors and team work in which patient is the most important and the active partner. The goal of management of this chronic disease is to minimize the symptoms, prevent the episodes of acute exacerbations and minimize the limitations in the routine activities⁷. The main stay of

Correspondence: Dr Muhammad Hammad Athar, Post Graduate Trainee Medicine, Military Hospital Rawalpindi Pakistan
Email: hammadathar614@gmail.com

Received: 12 Jun 2018; revised received: 17 Jul 2018; accepted: 21 Jul 2018

treatment in bronchial asthma is the inhaled medications causing the bronchodilation. The direct inhalation of medication to the site of disease process offers localized delivery of a high concentration of drugs to the lungs with minimal systemic adverse effects. The delivery pattern of inhaled drug is determined by number of factors including the type of device, aerosol formulation, particle size and the patient's inhalation technique. Metered dose inhalers are the most commonly used delivery devices for administering aerosolized drugs. Metered dose inhalers are practical, cost effective and convenient but technique dependent⁸.

Optimal drug delivery methods have been source of attraction for the physicians and researchers in the management of asthma. As per the Global Initiative for Asthma (GINA) guidelines, the ability to deliver drugs directly to airways pose a therapeutic advantage⁹. Guidelines and recent studies both focus on inhaler technique and adherence^{10,11}. Studies in the past have revealed that asthma control can be improved with good communication and demonstration of the inhaler techniques to the patients¹²⁻¹⁵.

Faulty inhalational technique compromises the use and efficacy of the inhaled drug. It is, therefore, beneficial for the patients with asthma to be educated and skilled regarding the inhaler technique via asthma clinics. This study was designed with the rationale to look for the impact of education of proper metered dose inhaler technique over peak expiratory flow rate among the patients of moderate persistent bronchial asthma.

PATIENTS AND METHODS

After approval from hospital ethical committee this interventional study was conducted at general medicine department Military Hospital Rawalpindi, from Dec 2017 to Jun 2018. Patients were selected using non-probability purposive sampling technique. Sample size was calculated by using the WHO calculator using the confidence interval and confidence level.

Confidence interval was determined by the sample size, percentage and the population size. Patients of both genders coming to outpatient department with moderate persistent asthma were included in the study. Patients less than 12 years and more than 80 years and with acute exacerbation history or oral steroid use in last three months were excluded from the study. Patients having IHD, heart failure, liver and kidney diseases, hematological or oncological disorders and chronic infections were also excluded from the study. Patients were divided into two groups by the lottery method for randomization. Group A did not receive the proper training for using the metered dose inhaler while group B received proper training to use the inhaler. Both groups were assessed by carrying out their peak expiratory flow rate via standard peak expiratory flow rate device. Mean PEFr was calculated and compared for both the groups.

Salbutamol

It is the agent used in the usual standard dose in metered dose inhaler in both the study groups. It is a β_2 -adrenergic agonist and acts as a bronchodilator. Its onset of action is within the minutes and effects last for 3-5 hours. Routine 100mcg inhaler was used and all the relative or absolute contraindications were ruled out prior to the use.

Metered Dose Inhaler Technique

Standard 12-point metered dose inhaler technique defined by the American thoracic society was used in the study.

Make sure that the metal canister of your MDI is inserted correctly into the plastic "boot" or holder (see drawing).

Remove the cap from the mouthpiece of both the MDI and the spacer.

Insert the MDI mouthpiece in the soft opening of the spacer. The MDI canister needs to be in an upright position.

Shake the MDI with attached spacer several times.

Breathe out, away from the spacer, to the end of your normal breath.

Place the mouthpiece of the spacer into your mouth, past your teeth and above your tongue. Close your lips around the mouthpiece. If you are using a spacer with a mask, place the mask over your nose and mouth. Be sure the mask has a good seal against your cheeks and chin. There should be no space between the mask and your skin.

Press down on the top of the metal canister once, to release the medicine into the spacer.

Peak expiratory flow rate: Peak expiratory flow rate (PEFR) is a person's maximum speed of expiration, as measured with a peak flow meter, a small, hand-held device used to monitor a person's ability to breathe out air. It measures the airflow through the bronchi and thus the degree of obstruction in the airways. Usual peak expiratory flow meters have scoring from 0 to 800 L/min. For patients to assess the control of asthma themselves, some meters have three interpretations;

Green Zone (80 to 100%) indicates that the

Table-I: Baseline characteristics of the study patients (n=200).

Variables	Group A (n=100)		Group B (n=100)		p-value
Age (years)					0.045
Mean ± SD	36.86 (± 4.945)		35.454 (± 4.945)		
Range (min-max)	15 - 65 years		15-65 years		
Duration of illness					0.116
<5years	62		51		
5 years or more	38		49		
Education					0.475
Less than Matriculate	60		55		
Matriculate or above	40		45		
Gender	Group A (n=100)	Percentage (%)	Group B (n=100)	Percentage (%)	p-value
Male	44	44	45	45	
Female	56	56	55	55	

Table-II: PEFR Scores of the patients in both the groups.

Characteristics	Group A (without training)	Group B (with training)	p-value
PEFR score, mean (SD)	320 ± 9.28	460 ± 6.66	<0.001

Breathe in deeply and slowly through your mouth. If the spacer makes a “whistling” sound, you are breathing in too fast. You should NOT hear a whistle.

Hold your breath for 5 to 10 seconds.

Breathe out slowly.

If you are instructed to take more than one puff (spray), wait about 15 to 30 seconds (or as directed by the package insert) before taking the next puff. Then repeat steps⁴⁻¹⁰.

Replace the cap on the mouthpiece of the MDI inhaler and spacer after you have finished.

asthma is under good control.

Yellow Zone (50 to 79%) indicates caution. It means respiratory airways are narrowing and additional medication may be required.

Red Zone (Less than 50%) Indicates a medical emergency¹⁵.

Data was analyzed by using Statistical Package for Social Sciences version 21.0. Descriptive statistics were used for the age, gender, education and duration of asthma. Mean PEFR score was calculated for the patients in both the groups after using the inhaler. Student t test

was applied to establish the difference in the efficacy of the proper technique and PEFR score of the two groups. Chi-square test was applied for the age and duration of illness. A *p*-value less than or equal to 0.05 was considered significant.

RESULTS

A total of 220 patients were approached to participate in the study. 05 refused participation and 10 were ineligible due to exclusion criteria (02 had uncontrolled DM, 05 were on oral steroids and 03 had chronic infections). After being consented, an additional 05 did not provide complete data at baseline, leaving 200 patients. Mean age of the patients was 38.86 (\pm 4.945). General characteristics of study participants are given in table-I. In group A (without the training for the use of metered inhaler) 44 patients were male and 56 were females. Whereas in group B 45 patients were male and 55 were female. Overall out of 200 patients, 170 (85%) patients had asthma for more than 5 years and only 30 had total disease duration of less than 5 years. Table-II shows that the mean PEFR score for group A was 320 ± 9.28 and for group B it was 460 ± 6.66 (*p*-value<0.001).

DISCUSSION

To our knowledge this is the first ever study regarding the metered dose inhaler technique carried out on the asthmatic patients presenting to outpatient department of military hospital Rawalpindi. The study is an attempt to evaluate the impact of educating the patients of asthma for metered dose inhaler technique on immediate outcome i.e peak expiratory flow rate. Asthma is a chronic disease which poses lot of physical and psychological problems for the patients who not only have to take the lifelong medications but also have to make certain life style modifications to control this disease effectively¹⁶. Unlike other expensive and sophisticated modes of treatment, metered dose inhaler is a cost-effective and efficient method to control this chronic disease¹³. Impact of using the inhaler with correct technique on disease control has been studied in the past^{13,17}. Our study showed a significant

difference in PEFR scores among the patients with and without the proper technique. These results are similar to the results of other studies done in various parts of the world on similar subject^{13,17,18}.

Once this fact is established that there is positive impact of proper metered dose technique on decreasing the symptomatology of asthma then next step is regarding the knowledge of correct technique among the health professionals. Various studies conducted in developed and underdeveloped countries highlighted the fact that most of the health professionals were not aware of the proper technique of metered dose inhaler¹⁹⁻²¹. Therefore our study can provide a rationale to carry out the studies on health professionals regarding the technique of metered dose inhaler.

Most of our patients had education less than matriculation. It can be a contributory factor in the improper use of metered dose inhaler and poor asthma control. This may also lead to progression of disease. The results of the studies done in the recent part showed different pattern. It has been observed that formal education is not linked to the poor disease control and only formal asthma control education is linked with the better outcome and good prognosis of the disease²²⁻²⁴. These studies support the rationale and findings of our study that formal asthma education in the clinics and training of patients regarding the metered dose inhaler technique can put a significant contribution in the symptoms of patients. Longitudinal studies can also confirm the long term consequences and help us in establishing the local guidelines regarding this subject in our setup.

Our study had few limitations. As education for technique has to be imparted in one group and not the other so blinding of patients and the staff was not possible. Outcome parameter was peak expiratory flow rate which is a crude method as compared to spirometry. Furthermore, the inclusion and exclusion criteria did not allow to study on mild or severe asthma, decreasing

the generalizability of this study. PEFR of both groups was not measured at base line prior to administration of the technique and starting the study. Outcome of this study can also not be generalized due to small sample size so we suggest further trials on a broader based and a more representative sample size to generate the generalizable results on this very important and cost-effective intervention.

CONCLUSION

This study showed that proper use of metered dose inhaler device has a significant impact on the PEFR. Proper time should be given by the physician or pharmacist to explain the patient regarding proper use of this device in order to ensure its optimal functioning.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

REFERENCES

- Chogtu B, Holla S, Magazine R, Kamath A. Evaluation of relationship of inhaler technique with asthma control and quality of life. *Indian J Pharma* 2017; 49(1): 110-15.
- Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention – Updated. 2007. [Last updated on 2015]. Available from: <http://www.ginasthma.com>
- Adams RJ, Smith BJ, Ruffin RE. Factors associated with hospital admissions and repeat emergency department visits for adults with asthma. *Thorax* 2000; 55(7): 566-73.
- Weiss KB, Gergen PJ, Hodgson TA. An economic evaluation of asthma in the United States. *N Engl J Med* 1992; 326(13): 862-66.
- AL-Jahdali H, Anwar A, AL-Harbi A, Baharoon S, Halwani R, AL-Shimemeri A et al. Factors associated with patient visits to the emergency department for asthma therapy. *BMC Pulmonary Medicine* 2012; 12: 80.
- Stewart WF, Ricci JA, Chee E, Morganstein D. Lost productive work time costs from health conditions in the United States: Results from the American Productivity Audit. *J Occup Environ Med* 2003; 45(12): 1234-46.
- NIH. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. Bethesda (MD): National Heart, Lung, and Blood Institute; 2007. National Asthma Education and Prevention Program. NIH Publication No. 07-4051. NIH Publication No 07-4051.
- Farooq MZ, Farooq MS, Waqar W, Mustaqeem M, Khan JA, Saadullah S. Assessment of inhalation technique among patients of chronic respiratory disorders in Civil Hospital Karachi: A cross sectional study *J Pak Med Assoc* 2016; 66(11): 1502-6.
- Bateman ED, Hurd SS, Barnes PJ, Bousquet J, Drazen JM, Fitz Gerald M, et al. Global strategy for asthma management and prevention: GINA executive summary. *Eur Respir J* 2008; 31(1): 143-78.
- Reddel HK, Bateman ED, Becker A, Boulet LP, Cruz AA, Drazen JM, et al. A summary of the new GINA strategy: A roadmap to asthma control. *Eur Respir J* 2015; 46(3): 622-39.
- Al-Zahrani JM, Ahmad A, AL-Harbi A, et al. Factors associated with poor asthma control in the outpatient clinic setting. *Ann Thorac Med* 2015; 10(2): 100-04.
- Javed M, Amin K, Yasmin G, Alam Z, Zikaria M. Metered dose inhalers; Errors in the use in Asthma and COPD *Professional Med J* 2004; 11(1): 63-7.
- Harnett CM, Hunt EB, Bowen BR, O'Connell OJ, Edgeworth DM, Mitchell P, et al. A study to assess inhaler technique and its potential impact on asthma control in patients attending an asthma clinic. *J Asthma* 2014; 51(4): 440-5.
- Ganguly A, Das AK, Roy A, Adhikari A, Banerjee J, Sen S. Study of Proper use of Inhalational Devices by Bronchial Asthma or COPD Patients Attending a Tertiary Care Hospital. *J Clin Diagn Res* 2014; 8(10): HC04-HC07.
- Melani AS, Bonavia M, Ciletti V, Cinti C, Lodi M, Martucci P et al. Inhaler mishandling remains common in real life and is associated with reduced disease control. *Respir Med* 2011; 105(6): 930-8.
- Nunn AJ, Gregg I. New regression equations for predicting peak expiratory flow in adults. *Br Med J* 1989; 298: 1068-70.
- Stucky BD, Sherbourne CD, Edelen MO, Eberhart NK. Understanding asthma-specific quality of life: Moving beyond asthma symptoms and severity. *Eur Respir J* 2015; 46(3): 680-87.
- Press VG, Arora VM, Trella KC, Adhikari R, Zadravec FJ, Liao C et al. Effectiveness of Interventions to Teach Metered-Dose and Diskus Inhaler Techniques. A Randomized Trial. *Ann Am Thorac Soc* 2016; 13(6): 816-24.
- Klijn SL, Hiligsmann M, Evers SMAA, Román-Rodríguez M, Molen T. Effectiveness and success factors of educational inhaler technique interventions in asthma & COPD patients: A systematic review. *NPJ Prim Care Respir Med* 2017; 27(1): 24.
- Ali HD, Worku GS, Alemayehu AA et al. Competence in metered dose inhaler technique among dispensers in Mekelle. *Allergy Asthma Clin Immunol* 2014; 10(1):18.
- Duka SO, Anetoh MU, Amorha KC, Henry OO, Okonta MJ. Use of simulated patient approach to assess the community pharmacists' knowledge of appropriate use of metered dose inhaler. *J Basic Clin Pharm* 2016; 7(4): 116-19.
- Han TM, Azhar S. A study investigating the community pharmacist knowledge about the appropriate use of inhaler. *Saudi Pharm J* 2013; 21(2): 153-7.
- Solé D, Aranda CS, Wandalsen GF. Asthma: epidemiology of disease control in Latin America – short review. *Asthma Res Prac* 2017; 3: 4.
- Azeez IA, Ladipo MMA, Ige OM. Assessment of socioeconomic status and control of asthma in adults. *Ann Ib Postgrad Med* 2016; 14(2): 85-91.