



## Original Research Article

# ASSESSMENT OF INHALATIONAL TECHNIQUES AND THEIR COMMON ERRORS AMONG ASTHMA PATIENTS: A CROSS-SECTIONAL STUDY

Mohammad Zaeem Khan<sup>1</sup>, Khalid Masood Usmani<sup>2</sup>, Jamil ul Hussain<sup>3</sup>, Reecha Gupta<sup>4</sup>, Rimsha Ahmed<sup>5</sup>, Sneh Kalgotra<sup>6</sup>

<sup>1</sup>Assistant Professor, Department of Respiratory Medicine, Govt medical college, Rajouri, Jammu and Kashmir, India

<sup>2</sup>Assistant Professor, Department of Medicine, Govt medical college Rajouri, Jammu and Kashmir, India

<sup>3</sup>Professor and HOD, Department of Medicine, Govt medical college Rajouri, Jammu and Kashmir, India

<sup>4</sup>Prof and HOD, Department of Prosthodontics and Crown & Bridge, IGGDC Jammu, Jammu and Kashmir, India

<sup>5</sup>Assistant Professor, Department of Prosthodontics and Crown & Bridge, IGGDC Jammu, Jammu and Kashmir, India

<sup>6</sup>Assistant Professor, Department of Orthodontics, IGGDC Jammu, Jammu and Kashmir, India

Received : 10/10/2025  
Received in revised form : 14/11/2025  
Accepted : 02/12/2025

### Corresponding Author:

**Dr. Khalid Masood Usmani,**  
Assistant Professor, Department of  
Medicine, Govt medical college  
Rajouri, Jammu and Kashmir, India.  
Email: km0658394@gmail.com

DOI: 10.70034/ijmedph.2025.4.555

Source of Support: Nil,  
Conflict of Interest: None declared

**Int J Med Pub Health**  
2025; 15 (4); 3101-3104

### ABSTRACT

**Background:** Asthma is a chronic inflammatory airway disease requiring long-term inhaler therapy. Correct inhaler technique is essential for optimal drug deposition in the lungs and adequate disease control. However, incorrect inhaler use remains highly prevalent worldwide and is associated with poor symptom control, frequent exacerbations, and increased healthcare utilization. The objective is to assess the prevalence and pattern of inhaler technique errors among asthma patients and to identify factors associated with incorrect technique.

**Materials and Methods:** This cross-sectional observational study included 225 adult asthma patients attending the respiratory outpatient department. Patients using inhaler therapy for at least three months were asked to demonstrate their inhaler technique. A standardized checklist based on GINA guidelines were used to identify critical and non-critical errors.

**Results:** The prevalence of incorrect inhaler technique was 62.6%. The most common critical error was not able to do slow and deep inhalation and holding breath for 10 s due to lack of hand-mouth coordination at the time of actuation.

**Conclusion:** Inhaler technique errors remain common and this highlights the need for assessment and structured patient education programs.

**Keywords:** Asthma, Inhaler Technique, Metered Dose Inhaler, Dry Powder Inhaler, Critical Errors.

## INTRODUCTION

Asthma is a chronic respiratory disorder characterized by airway inflammation, bronchial hyper responsiveness, and reversible airflow limitation. It affects millions of individuals worldwide and represents a significant public health burden.<sup>[1]</sup> The the first line of treatment of asthma management involves the use of inhaled medications, including inhaled corticosteroids and bronchodilators, which provide targeted drug delivery directly to the airways.<sup>[2]</sup>

The effectiveness of inhaled therapy depends heavily on correct inhaler technique. Improper use of inhalers can lead to inadequate drug deposition in the lungs,

resulting in poor symptom control, frequent exacerbations, and unnecessary escalation of therapy.<sup>[3]</sup> Studies across different populations have consistently reported a high prevalence of inhaler technique errors, even among patients receiving long-term therapy.

Common errors include failure to shake the inhaler (for metered-dose inhalers), poor coordination between actuation and inhalation, inadequate inspiratory effort, failure to hold breath after inhalation, and incorrect loading of dry powder inhalers. Some of these errors are considered critical, as they significantly reduce drug delivery to the lower airways.<sup>[4]</sup>

Despite advancements in inhaler devices and repeated educational interventions, improper technique persists. Regular evaluation of inhaler technique in clinical practice is therefore essential. This study aims to assess the prevalence and types of inhaler technique errors among asthma patients and to explore factors associated with incorrect technique in a tertiary care setting.

Different types of inhalational devices are available, but pressurized metered-dose inhalers (MDIs) and dry powder inhalers (DPIs) are the devices most commonly used for drug delivery in the treatment of asthma<sup>5</sup>. A large number of asthma patients do not use their inhaler devices correctly. Errors in device use may impact the effectiveness of the delivered drug and thereby lead to the suboptimal control of asthma.<sup>[2-5]</sup> It is, therefore, important to understand and quantify the device usage errors so that patient interventions can be effectively instituted, and new devices can be designed so that common errors can be avoided.

Misuse of inhalers and improper inhalation technique have been commonly observed in clinical practice, and it is associated with increased inhaler use, decreased bronchodilation, reduced patient's adherence to the treatment regimen, poor drug delivery, and disease control.<sup>[2,3]</sup>

In the present study, there was a plan to assess the inhalational techniques of eligible bronchial asthma patients and associated common errors performed during the techniques so that insinuations for maximum clinical benefits of inhaler use can be discussed.

### Objectives

1. To assess the correctness of techniques used by the patients under the study according to the standard checklist
2. To document the common errors committed by the patients in the use of inhalational techniques.

## MATERIALS AND METHODS

**Study Design and Setting:** This cross-sectional, hospital-based observational study was conducted among the bronchial asthma patients presenting at the outpatient department (OPD) as well as inpatient department in a tertiary care hospital of Northern India. A total of 225 patients of bronchial asthma (as diagnosed by pulmonologist) who attended the OPD of respiratory medicine department over the span of 6 months, as per the inclusion and exclusion criteria, were enrolled.

A well-informed, written, as well as oral, consent was obtained from all the participants after explaining the procedure. For underage patients below 18 years, parent's consent was taken. For illiterate patients, the left thumb impression was taken after explaining full study and confirmation of their willingness to participate in the study. Furthermore, confidentiality of patients' data was maintained.

**Study Population:** Adult patients diagnosed with asthma according to standard clinical and spirometric criteria and receiving inhaler therapy for at least three months were eligible.

### Inclusion Criteria:

- 14 to 70 years of age, of either gender, and using inhaler therapy (MDI or DPI) were included.
- Confirmed diagnosis of asthma (according to the GINA guidelines) from
- On inhaler therapy for  $\geq 3$  months
- Willingness to participate

### Exclusion Criteria:

- Acute asthma exacerbation at the time of assessment
- Severe cognitive impairment
- Inability to demonstrate inhaler use

**Data Collection Procedure:** After obtaining informed consent, demographic details such as age, gender, education level, duration of asthma, and type of inhaler device were recorded. Patients were then asked to demonstrate their inhaler technique using their own device.

**Assessment of Inhaler Technique:** A standardized checklist based on Global Initiative for Asthma (GINA) recommendations<sup>6</sup> were used. Each step were marked as correct or incorrect. Errors were classified as critical or non-critical based on their potential impact on drug delivery.

### Outcome Measures:

**Primary Outcome:** Prevalence of at least one inhaler technique error.

**Secondary Outcomes:** Most common type of error and factors associated with incorrect technique.

The DPI which was used was Rotahaler with a combination of budesonide 200  $\mu\text{g}$  + formoterol 6  $\mu\text{g}$ . The MDI also contained the same dose of budesonide and formoterol. Each participant was initially judged for eligibility criteria by the pulmonologist, and after the patients gave consent to participate, they were included in the study. Those patients not willing to participate in the research, those who suffered from other complications apart from asthma, and critically ill patients were excluded from the study.

A predesigned structured questionnaire was used for taking interview from the eligible participant. Data were collected from the patient within 15 min in a single sitting, and it did not require any follow-up. The inhalational technique was directly observed by the investigator and the pulmonologist, and the evaluation of techniques was made according to the requisite steps of correct usage for each inhaler device. If mistakes were found in one or more steps, it was classified as "incorrect" inhalational technique. Patient's age, sex, diagnosis, educational level, occupation, form of inhaler therapy, patient's awareness of the diagnosis, and initial education of therapy were asked and recorded in the case study form.

**The standardized steps for the inhalation technique were as follows:**

**Pressurized metered-dose inhaler**

1. Does patient shake the inhaler before use?
2. Does the patient breathe out before firing?
3. Does the patient hold the inhaler upright during firing?
4. Does the patient place the mouthpiece between the lips and over the tongue?
5. Does the patient take a breath during the first half actuation?
6. Does the patient take a deep breath till total lung capacity while firing?
7. Does the patient inhale by mouth and hold his/her breath for 10 s?
8. Does the patient tilt the head back?
9. Does the patient exhale till residual volume (RV)?
10. Does the patient wait for 30 s before administration of the next puff?

**DPI**

1. Does the patient remove cover and correctly insert the capsule?
2. Does the patient correctly pierce the capsule and load the required dose?
3. Does the patient hold the inhaler upright during firing?
4. Does the patient breathe out the device mouthpiece?
5. Does the patient inhale deeply and quickly?
6. Does the patient use mouth inhalation?
7. Does the patient place the mouthpiece between the lips and over the tongue?
8. Does the patient do forceful and deep inhalation?
9. Does the patient exhale till RV through the nose?
10. Does the patient control breath holding if the capsule is broken or does not contain powder?

**Statistical analysis and tools used:** Data were entered into MS Excel 2010. Data were analyzed using Epi Info 7.0 and SPSS 16.0. (SPSS Inc. Released 2007. SPSS for Windows, Version 16.0. Chicago, IL, USA, SPSS Inc.) Appropriate frequencies, percentages, and proportions were calculated, and necessary statistical tests were applied.

## RESULTS

As per the demographic data of the patients, no significant associations were found between age, education, occupation, and demographic variation with the technique of inhalation.

Among 225 patients, only 84 (37.4%) patients were able to perform inhaler technique correctly. Among 141 patients doing incorrect technique, 42 patients were on MDI and 99 patients had DPI. The details of the patients and the errors they made are tabulated in [Table 2 and 3].

Patients made errors in one or more steps of the inhaler technique. Among patients on MDI, the steps at which maximum number of mistakes done were at Steps 6 and 7 in which patients were not able to do

slow and deep inhalation and holding breath for 10 s due to lack of hand-mouth coordination at the time of actuation. The next common mistake was that multiple actuations were also observed without waiting for 30 s for the next puff (Step 10). Another common mistake was at Steps 8 and 9 which was to tilt the head back with holding breath for at least 10 s before exhalation. In the present study, 99 (44%) patients who were on DPI demonstrated incorrect technique. The step at which maximum patients committed mistake was at Step 4. Patients forgot to breathe out before starting rapid and forceful inhalation (Step 5) from device. The next major incorrect steps were not breathing out till RV (Step 10) after inhalation from the device and not holding breath (Step 11). 116 patients (51.5%) had poor control of asthma symptoms possibly because of incorrect technique.

## DISCUSSION

Inhalers are considered as the main stay of the treatment of asthma worldwide. Asthma will remain poorly controlled if there is improper technique of using inhalers.<sup>[7]</sup> The technique of use of inhalers by our patients was analysed and the patients were educated about measures needed to optimise drug delivery for better clinical control.

The mean age of 225 respondents was 45.5 years, 57.71% being women. No associations were found between inhalational technique and gender, age, ethnicity, education, and occupation. Of the 225 patients, only 67 patients were using MDI, of whom 42 patients were doing improper technique. In a similar study done in Nigeria, 79.8% of the participants used MDI incorrectly.<sup>[8]</sup> This can be due to less number of patients taking MDI in our study. According to studies, slow and deep inhalation followed by holding breath for at least 10 s is crucial for effective drug deposition. In our study, 31 patients failed to do so, making it the most common error. A similar study conducted in Nigeria demonstrated that most patients failed to do this step properly. It is essential to keep a gap of 30-60 s between two doses that allow medication to take action and relax airways.<sup>[9]</sup> Twelve (6.43%) patients were doing multiple actuations without any time gap. A study done in Saudi Arabia demonstrated that 80% of the patients did mistake at this step.<sup>[10]</sup>

This study aims to highlight the magnitude of inhaler technique errors among asthma patients. Inhaler technique errors remain highly prevalent among asthma patients. Regular assessment, patient education, and reinforcement of proper inhaler technique should be integrated into routine asthma management to improve disease control and reduce preventable exacerbations.

Previous literature has consistently shown that improper inhaler use is common and significantly affects asthma control. The findings of the present study are expected to align with global data

demonstrating high prevalence rates of incorrect technique.

Critical errors such as poor coordination, inadequate inspiratory effort, and failure to hold breath are particularly concerning, as they directly impact pulmonary drug deposition. Identification of associated factors such as lower educational status, older age, and longer duration of disease can help clinicians target high-risk groups for focused interventions.

Routine reassessment of inhaler technique during outpatient visits, use of visual aids, and structured education programs may significantly reduce error rates. Incorporating pharmacist-led or nurse-led inhaler education sessions may also improve outcomes.

Limitations of this study may include single-center design and reliance on direct observation, which could introduce observer bias.

In our settings, the most common form of inhaler therapy was DPI. When we assessed the technique of using DPI, the most common error was failure to exhale before using inhaler. It was observed in 41 (62.6%) patients. This result matches well with a similar study done in Pakistan in which failure to exhale before inhalation was the most common error observed.<sup>[11]</sup> Another error observed was failure to do forceful and deep inhalation, which is the most crucial step in effective drug delivery to airways. A similar error is found in a study done in Madhya Pradesh, India.<sup>[12]</sup>

According to the GINA guidelines when we assessed clinical control of symptoms in relation to inhaler technique, 69 (43.6%) patients had poor or partial clinical control with incorrect technique. It indicates that poor inhaler technique is the most important risk factor for poor clinical control. This can be correlated well with the study done in Ethiopia in which 80% of the patients were partially or poorly controlled with improper technique.<sup>[9]</sup> Thus, this study indicates that asthma control status is significantly associated with inhalation technique ( $P < 0.00001$ ). No significant association was seen between side effects associated with inhaler and the technique or dosage.

It is important that active measures should be taken to improve patients' basic knowledge regarding asthma diagnosis and inhaler technique. Apart from the current guidelines demonstrating complete steps of use of different inhalers, verbal guidance and visual demonstration in small groups or video tutorials should also be provided to improve measures. It is important to determine patient's preference while prescribing inhaler for the first time

so that compliance and acceptance for prescribed device will be better.

## CONCLUSION

There is a significant association between the proper use of inhaler technique and good clinical asthma control. Health professional should educate patients about inhalational technique during their first visit and constantly ask patients to bring inhaler in successive visits so that technique, compliance, and effective clinical control can be assessed for better outcomes.

## REFERENCES

1. Al Jahdali H, Ahmed A, Al Harbi A, Khan M, Baharoon S, Bin Salih S, et al. Improper inhaler technique is associated with poor asthma control and frequent emergency department visits. *Allergy Asthma Clin Immunol* 2013;9:8.
2. Melani AS, Bonavia M, Cilenti 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;105:930-8.
3. Hesselink AE, Penninx BW, Wijnhoven HA, Kriegsman DM, van Eijk JT. Determinants of an incorrect inhalation technique in patients with asthma or COPD. *Scand. J. Prim Health Care* 2001;19:255-60.
4. Giraud V, Roche N. Misuse of corticosteroid metered dose inhaler is associated with decreased asthma stability. *Eur Respir J* 2002;19:246-51.
5. Lindgren S, Bake B, Larsson S. Clinical consequences of inadequate inhalation technique in asthma therapy. *Eur J Respir Dis* 1987;70:93-8.
6. World Health Organization. WHO GINA Report. Global Strategy for Asthma Management and Prevention, Updated 2018. World Health Organization; 2018.
7. 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:HC04-7.
8. Janaina BM, Carlos RP, Irma G. Inhaled medication for asthma management: Evaluation of how asthma patients, medical students, and doctors use the different devices teach. *J Pneumol* 2003;29:75-81.
9. Kebede B, Mamo G, Molla A. Association of asthma control and metered dose inhaler use technique among adult asthmatic patients attending outpatient clinic, in resource limited country: A prospective study. *Can Respir J* 2019;2019:6934040.
10. 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. *Ann Med Health Sci Res* 2014;4:67-73.
11. Al Wasil MA, Al Mohaimeed A. Assessment of inhalation technique in primary care asthmatic patients using metered dose inhalers with or without a spacer. *Ann Saudi Med* 2003;23:264-9.
12. Farooq MZ, 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;66:1502.