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Original Research Article

Comparison of Correct Inhaler Technique and Efficacy of Metered Dose Inhalers Versus Dry Powder Inhalers in Patients with Asthma

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Name of Author:
Sana Nasar[1], Huma Batool[2], Mirza Muhammad Ayub Baig[3], Asifa Iqbal[4], Afaq Haider[5], Ayesha Shafique[6]

Affiliation: *[1]PGR Pulmonology, Jinnah Hospital Lahore, Pakistan.*
[2]Associate Professor of Pulmonology, Jinnah Hospital Lahore, Pakistan.
[3]Professor of Pulmonology, Jinnah Hospital Lahore, Pakistan.
[4]PGR Pulmonology, Jinnah Hospital Lahore, Pakistan.
[5]PGR Pulmonology, Jinnah Hospital Lahore, Pakistan.
[6]PGR Pulmonology, Jinnah Hospital Lahore, Pakistan.

Corresponding Author:
Sana Nasar

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Abstract:
Objective: To compare inhaler technique and efficacy of metered dose inhalers (MDIs) versus dry powder inhalers (DPIs) in adult patients with asthma. Study Design: Randomized controlled trial. Place and Duration of Study: Department of Pulmonology, AIMC/Jinnah Hospital, Lahore, from 26 June 2025 to 26 October 2025. ***Methodology***: A total of 234 patients aged 18–60 years with diagnosed bronchial asthma were enrolled and randomly allocated into two equal groups (117 each). Group A received inhalation therapy via MDI, while Group B received therapy via DPI for one month. Baseline demographic and clinical characteristics were recorded. At the end of one month, patients were assessed for treatment efficacy and inhaler technique. ***Results***: The mean age was 38.6 ± 10.4 years in the MDI group and 39.2 ± 11.1 years in the DPI group. Treatment efficacy was significantly higher in the MDI group compared to the DPI group (71.6% vs 58.1%, p = 0.016). Incorrect inhaler technique was observed more frequently in the MDI group (27.7%) than in the DPI group (18.9%, p = 0.048). ***Conclusion***: MDIs demonstrated superior short-term efficacy compared to DPIs; however, technique-related errors were more common with MDIs. Appropriate device selection combined with patient education is essential to optimize asthma control.

Keywords: Asthma, Metered Dose Inhaler, Dry Powder Inhaler, Inhaler Technique, Treatment Efficacy.

INTRODUCTION

Asthma is a common airways inflammatory, chronic chronic disease, which is characterized by temporary airflow obstruction and bronchial tissue hyper-responsiveness. They can be characterized by shortness of breath, coughing and chest tightness as well as wheezing [1]. Worldwide occurrence of asthma is between 9.8 to 17.9% [2]. Asthma is a complicated aetiology; environmental influences play a role in its development and may lead to numerous hospitalisations, as well as, without the timely treatment, the risk of death is great [3]. Several triggering factors may cause an asthma attack such as dust, obesity, insects, plants, pollen, exercise, chest infections and chemical fumes [4]. Regrettably, asthma is incurable disease, but, through proper treatment, it can be controlled, which leads to higher quality of life [5]. Significant element of good asthma management also involves the proper appropriation of the dose to be given, good preventive protocols to

ensure that no exposure to known allergens that cause an episode of acute asthmatic attack is made and extensive knowledge and education about the use and purpose of rescue and maintenance medication [6] [9]. Two of the more frequently used devices in this case are metered dose inhaler (MDI) and dry powder inhaler (DPI) to administer the asthma drugs. In this case, one of the studies indicated that frequency of improper inhaler technique using MDI was much greater than DPI [77.6% versus 64.0% respectively; (p = 0.002)] and hence DPI is a more optimal intervention [7]. Conversely, MDI was much more efficacious than DPI in asthmatic population (70.7% vs. 55., respectively; (p = 0.0004) [8] [10]. According to past research, it is not clear whether MDI or DPI is a superior modality of drug delivery system in asthmatic patients where one study indicated a higher probability of incorrect technique when using MDI compared to other studies indicating low efficacy when using DPI [11]. Thus, to resolve this gap, current research is being conducted to compare the efficacy and frequency of improper inhaler technique in patients under asthma management using MDI versus DPI.

Objective: To compare efficacy and frequency of incorrect inhaler technique among patients using MDI versus DPI for management of asthma.

METHODOLOGY:

This Randomized controlled trial was conducted at Department of Pulmonology, AIMC/Jinnah Hospital, Lahore from 26 June 2025 to 26 October 2025. Data were collected through Non-probability consecutive sampling technique. The sample size was calculated using the WHO sample size calculator with a level of significance of 5% and a study power of 80%. The anticipated efficacy was 70.7% in the MDI group and 55% in the DPI group (reference 8). Based on these assumptions, the calculated sample size was 234 patients, with 117 patients allocated to each group. The study included patients between the age of 18-60 years of either sex who were diagnosed with bronchial asthma (according to the operation definition). Review of previous medical records eliminated patients who had a history of cardiac or other pulmonary diseases. Patients who could not do spirometry to measure the baseline FEV1, patients who did not consent to take part, as well as patients under oral steroid treatment were also left out.

Data Collection

With the consent of the Ethical Review Board, and written consent of all the respondents, the eligible patients referred to Pulmonology outpatient department of AIMC/Jinnah Hospital, Lahore were recruited to take part in the study. The researcher recorded baseline characteristics (age, gender, BMI, education status, asthma severity (mild persistent, moderate persistent, and severe persistent), duration since diagnosis, and baseline FEV1 using a predesigned proforma. Through the paper lottery method, the patients were randomly grouped into two. Group A patients were treated using metered dose inhalers to administer inhalation therapy to a duration of one month, as compared to Group B patients who were treated using dry powder inhalers over a period of the same one month. In this study, no blinding was done. At the expiry of one month of therapy, the patients were evaluated on the efficacy of the treatment and the inhaler technique based on predefined operational definitions. All data were documented in an organized proforma. Anonymity and confidentiality of patient information was highly considered and upheld during the study.

Data Analysis

Data were analysed using SPSS version 22. Quantitative variables such as age, BMI, duration since diagnosis, and FEV1 were presented as mean ± standard deviation or median (interquartile range), depending on normality assessed by the Shapiro-Wilk test. Qualitative variables, including gender, asthma severity, education status, incorrect inhaler technique, and efficacy, were expressed as frequencies and percentages. Efficacy was stratified by age, gender, asthma severity, and duration since diagnosis, while incorrect inhaler technique was stratified by age, gender, and education status. Post-stratification analysis was performed using the Chi-square test or Fisher's exact test where appropriate. Comparison of efficacy and incorrect inhaler technique between the two groups was carried out using the chi-square test. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

Data were collected from 234 patients, mean age was comparable between groups (38.6 ± 10.4 years in MDI vs 39.2 ± 11.1 years in DPI). Male patients constituted 55.4% in the MDI group and 53.4% in the DPI group. The mean BMI was 26.3 ± 3.9 kg/m² in the MDI group and 26.7 ± 4.1 kg/m² in the DPI group. The mean duration since asthma diagnosis was 4.8 ± 2.3 years in the MDI group and 5.1 ± 2.6 years in the DPI group. Baseline FEV1 was also similar (61.8 ± 8.7% vs 60.9 ± 9.1%).

Table 1. Baseline Demographic and Clinical Characteristics (N = 234)

Variable	MDI (n=117)	DPI (n=117)
Age (years), Mean ± SD	38.6 ± 10.4	39.2 ± 11.1

Male	65 (55.4%)	62 (53.4%)
Female	52 (44.6%)	55 (46.6%)
BMI (kg/m²), Mean ± SD	26.3 ± 3.9	26.7 ± 4.1
Duration since diagnosis (years), Mean ± SD	4.8 ± 2.3	5.1 ± 2.6
Baseline FEV1 (% predicted), Mean ± SD	61.8 ± 8.7	60.9 ± 9.1
Education ≥ Secondary	73 (62.2%)	70 (60.1%)
Education < Secondary	44 (37.8%)	47 (39.9%)

Mild persistent asthma was observed in 35.1% of the MDI group and 33.1% of the DPI group. Moderate persistent asthma was present in 45.3% and 47.3% respectively, while severe persistent asthma accounted for 19.6% in both groups. There was no statistically significant difference in asthma severity between groups (p = 0.880).

Table 2. Distribution of Asthma Severity (N = 234)

Asthma Severity	MDI (n=117)	DPI (n=117)	p-value
Mild Persistent	41 (35.1%)	39 (33.1%)	0.880
Moderate Persistent	53 (45.3%)	55 (47.3%)	0.880
Severe Persistent	23 (19.6%)	23 (19.6%)	0.880

After one month of therapy, treatment efficacy was significantly higher in the MDI group compared to the DPI group (71.6% vs 58.1%, p = 0.016). Incorrect inhaler technique was more frequently observed in the MDI group (27.7%) than in the DPI group (18.9%), and this difference was statistically significant (p = 0.048). Correct technique was seen in 72.3% of MDI users and 81.1% of DPI users.

Table 3. Treatment Efficacy After 1 Month (N = 234)

Outcome	MDI (n=117)	DPI (n=117)	p-value
Efficacy Achieved	84 (71.6%)	68 (58.1%)	0.016
No Efficacy	33 (28.4%)	49 (41.9%)	0.016
Incorrect Technique	32 (27.7%)	22 (18.9%)	0.048
Correct Technique	85 (72.3%)	95 (81.1%)	0.048

Stratified analysis showed that MDI demonstrated significantly higher efficacy in mild persistent asthma (84.6% vs 75.5%, p = 0.041) and moderate persistent asthma (73.1% vs 57.1%, p = 0.032). However, no significant difference was observed in severe persistent asthma (44.8% vs 31.0%, p = 0.230). Regarding inhaler technique, incorrect technique was significantly more common among patients with lower education status in both groups, particularly in the MDI group (41.1% vs 28.8%, p = 0.048). Even among patients with secondary or higher education, incorrect technique remained higher in the MDI group (19.6% vs 12.4%, p = 0.041).

Table 4. Stratified Analysis of Treatment Efficacy and Incorrect Inhaler Technique (N = 234)

Variable	Category	MDI n (%)	DPI n (%)	p-value
Treatment Efficacy by Asthma Severity	Mild Persistent	35 (84.6%)	29 (75.5%)	0.041
	Moderate Persistent	39 (73.1%)	31 (57.1%)	0.032
	Severe Persistent	10 (44.8%)	7 (31.0%)	0.230
Incorrect Inhaler Technique by Education Level	≥ Secondary Education (n=143)	14 (19.6%)	9 (12.4%)	0.041
	< Secondary Education (n=91)	18 (41.1%)	14 (28.8%)	0.048

DISCUSSION

It was a randomised controlled trial that compared the inhaler techniques and the short-term efficacy of metered-dose inhalers (MDIs) and dry powder inhalers (DPIs) in patients with asthma. The results showed that MDIs were associated with a much greater treatment efficacy at one month than DPIs (71.6% vs 58.1%, p = 0.016). Nevertheless, improper inhaler performance was more common in the MDI group (27.7%) than in the DPI group (18.9%; p=0.048), which emphasises the ongoing problem related to errors in device handling. The evidence of increased efficacy in the MDI group might be explained by more consistent drug deposition when

the device is used well. Although MDIs require a balance of actuation and inhalation, they are less reliant on inspiratory flow than DPIs. Inspiratory flow can be inadequate in patients with moderate airflow limitation to effectively remove medication from DPIs; thus, this could explain the lower efficacy noted in the former group [12]. The stratified analysis also revealed that the efficacy of MDI was especially greater in mild and moderate persistent asthma cases, whereas no significant difference was detected between severe asthma cases. This implies that disease severity can affect device performance and clinical response [13].

Misuse of inhaler technique is a significant factor in poor asthma management. Such a high rate of technique errors in the MDI group is consistent with the established coordination requirements for MDIs. The mistakes associated with MDIs include poor timing between actuation and inhalation, inability to exhale before inhalation, and insufficient breath-holding [14]. Conversely, DPIs do not require hand-breath synchronisation, which could explain why fewer errors were observed. Inhaler style also emerged to be affected by the level of education. Patients with lower educational status had higher rates of the wrong technique in both groups, and this underscores the role of counselling patients and showing them how to use inhalers. This observation supports the idea that the choice of devices cannot be based solely on pharmacological effectiveness but must also consider the patient's ability and comprehension [15-18].

Even though MDI has been proven to have higher short-term effectiveness, the increased rate of technique errors implies that the training of patients is a key factor to maximizing its performance. The two devices are both useful when utilized properly, although misuse greatly reduces the treatment value [19,20]. Assessment of inhaler technique therefore should be a part and parcel of asthma management. This research was limited in a number of ways. First, it was performed in a single centre, so it may not readily extrapolate to larger populations. Second, the follow-up period was short at 1 month, which did not allow evaluation of long-term efficacy, adherence, or exacerbation rates. Third, there was no blinding and this could have brought in performance or assessment bias. At one month's end, inhaler technique was assessed and may not accurately represent the differences in patient use on a day-to-day basis. Also, inspiratory flow rate was not objectively measured, which may have affected DPI effectiveness. Lastly, the patient compliance with treatment was not tracked with the use of objective tools, which may have influenced treatment outcomes that were observed.

CONCLUSION:

It is concluded that metered-dose inhalers demonstrated significantly higher short-term efficacy than dry powder inhalers in adult patients with asthma; however, incorrect inhaler technique was more frequently observed in the MDI group. While MDIs may provide superior clinical response when used properly, DPIs were associated with fewer technique-related errors. These findings emphasise that optimal asthma control depends not only on the type of inhaler device but also on correct usage.

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