

Comparison of Efficacy of Metered Dose Inhaler and Dry Powder Inhalation in Treatment of Persistent Asthma

Muhammad Fahad, Rameesha Hussain, Sajjad Hussain, Arooj Fatima, Maryam Paracha

ABSTRACT

Objective: To compare the efficacy of dry powder inhaler versus metered dose inhaler for control of persistent asthma in terms of a mean difference of 500 ml improvement in FEV₁ amongst the two groups. **Study design:** It was Randomized Controlled Trial. **Settings:** The study was conducted in Medicine Department, Services Hospital, Lahore. **Duration:** From October 19, 2017 to April 19, 2018. **Methodology:** A total of 458 patients who fulfilled the inclusion criteria were enrolled in the study. 229 patients in each group were divided using lottery method into two groups (Group-A & Group-B). Metered Dose Inhaler was given to group-A patients for 4 weeks. Dry Powder Inhaler was given to group-B patients for 4 weeks. Follow up by 4th week was done by patient's outdoor visits by doing pulmonary function tests and measuring forced expiratory volume 1 second. All the collected information was transferred to SPSS v23.0 and analyzed accordingly. Data were stratified for gender, age and duration of disease to address the effect modifiers. For post-stratification, Chi-Square test was used taking p-value ≤ 0.05 as significant. **Results:** A total of 458 patients with asthma were examined in this study. Patients were randomly divided in two groups i.e. Group-A (Metered Dose Inhaler) and Group-B (Dry Powder Inhaler). Efficacy was found in 162(70.7%) patients in group-A (Metered Dose Inhaler) while in 126(55.0%) patients in group-B (Dry Powder Inhaler) with a p-value as 0.0004 which was statistically significant. **Conclusion:** Metered Dose Inhaler (MDI) provides significant improvements in FEV₁ versus Dry Powder Inhaler (DPI)

Keywords: Dry Powder Inhaler (DPI), FEV₁, Metered Dose Inhaler (MDI), Asthma.

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INTRODUCTION

Asthma is the most common chronic disease among children and young adults and is one of the biggest financial health burdens worldwide. It is responsible for a significant chunk of healthcare costs.¹ A study carried out in Karachi showed that its prevalence in Pakistan to be 15.8%.² Recently, it has been seen that the combination therapy of a long-acting β_2 -agonist (LABA) with inhaled corticosteroid (ICS) therapy is more effective than ICS alone, in improving asthma control in symptomatic asthmatic patients. It is due to this fact that LABA and ICS co-prescription is now an integral part of Asthma treatment guidelines.³

Inhaled Corticosteroid Steroid and a Long Acting Beta Agonist together in one inhaler helps to advance patient's adequacy and conformity after taking both therapies.⁴ Studies have shown that dry powder inhalers (DPI's) and metered dose inhalers (MDI's) have equal efficacy though further studies are required to establish this fact.

DPIs are becoming more popular because of their ease of use and the powder stability. MDIs are still facing challenges from the formulation and the design point of view.⁵ DPI inhalers are offering more flexibility and cost effectiveness in asthma patients.⁶

However, it has been experimented in recent practice clinically particularly, use of metered dose inhalers more popular than dry

powder inhalers though recently later is becoming more popular in our country. In one study by Miyahara H et al, Measurements done after DPI and MDI therapies, FEV (1.0) 84.1 \pm 16.3% versus 91.5 \pm 18.2%.⁷ This study was done in pediatric population.

High helpful adequacy was acquired with the utilization of the MDI in formoterol inhalation for post-grade school age patients with adequate motivation capacity. For the treatment of bronchial asthma, two sorts of formoterol inhaler gadgets are accessible, in particular, metered-portion inhaler (MDI) and dry powder inhaler (DPI). The previous is suggested for children with a low pinnacle inspiratory stream.⁷

It was seen that a minimal improvement of FEV₁ of 230 ml is reported as an improvement by patients, however, between 400 to 500 ml, 90% of asthmatics report improvement.⁸ The efficacy of MDI and DPI was 58% and 51% respectively.⁹ Efficacy of MDI was 62.5%.¹⁰

METHODOLOGY

Study Design: It was Randomized Controlled Trial.

Settings: Medicine Department, Services Hospital, Lahore-Pakistan

Duration: From October 19, 2017 to April 19, 2018.

Methods: A total of 458 patients fulfilling inclusion criteria (Both male and female, Age ranges from 18-70 years of both genders,

Persistent Bronchial Asthma for at least 6 months, no oral treatment previously) were enrolled in the study.

The exclusion criteria were; Upper or Lower respiratory tract infection (As assessed by history, examination and chest x-ray PA view), Pregnancy (History of Gestational Amenorrhea or Pregnancy Test positive), Lactating Mother, Oral corticosteroids within 4 weeks or depot steroids within 12 weeks of first visit, Acute asthma exacerbation (requiring emergency treatment or hospitalization) within 4 weeks of first visit, Smoking history of more than 10 pack years.

229 patients in each group were divided into two groups using lottery method (Group A & Group B. Inhaler Foracort (Metered Dose Inhaler) device was given with a dose of 6/400 µg with ABLE device two times a day for 4 weeks to group-A patients.⁷ Combivair Rotacaps (Dry Powder Inhaler) was given with a dose of 400/6 µg with Revolizer two times a day for 4 weeks to group-B patients. Follow up by 4th week was done by patient's outdoor visits by doing pulmonary function tests and measuring forced expiratory volume 1 second. Information comprised age, sex, address, and contact number forced expiratory volume 1 at baseline and 4th week of treatment were collected by trainee researcher.

Efficacy was measured in terms of pulmonary function test showing 500 ml or more improvement in FEV₁ at end of 1-month treatment. Improvement was measured by: (FEV₁ at 1 month - FEV₁ at baseline).

All the data were entered to SPSS v23.0 and analyzed accordingly. Mean±S.D was calculated for quantitative variables like FEV₁ and age. Frequencies and percentages were calculated for qualitative variables like gender and efficacy. To compare the efficacy in both groups, Chi-Square test was applied. Data were stratified for gender, age and duration of disease to address the effect modifiers. For post stratification, Chi-Square test was used and p-value ≤0.05 was considered significant.

RESULTS

Total 458 patients with asthma were enrolled in this study. Patients were divided in two groups i.e. Group-A (Metered Dose Inhaler) and Group-B (Dry Powder Inhaler). There were 164(71.6%) males and 65(28.4%) females in group-A, while 151(65.9%) were males and 78(34.1%) females in group-B.

Table 1: Comparison of gender distribution in both groups

Gender	Groups		Total
	Metered Dose Inhaler (MDI)	Dry Powder Inhaler (DPI)	
Male	164	151	315
	71.6%	65.9%	68.8%
Female	65	78	143
	28.4%	34.1%	31.2%
Total	229	229	458
	100.0%	100.0%	100.0%

Table 2: Comparison of age distribution in both groups

Age groups	Groups		Total
	Metered Dose Inhaler (MDI)	Dry Powder Inhaler (DPI)	
18-30 years	63	57	120
	27.5%	24.9%	26.2%
31-45 years	59	71	130
	25.8%	31.0%	28.4%
>45 years	107	101	208
	46.7%	44.1%	45.4%
Total	229	229	458
	100.0%	100.0%	100.0%

Table 3: Comparison of duration of disease distribution in both groups

Duration of disease	Groups		Total
	Metered Dose Inhaler (MDI)	Dry Powder Inhaler (DPI)	
upto 1 year	80	86	166
	34.9%	37.6%	36.2%
1-5 years	75	77	152
	32.8%	33.6%	33.2%
>5 years	74	66	140
	32.3%	28.8%	30.6%
Total	229	229	458
	100.0%	100.0%	100.0%

Table 4: Comparison of efficacy of both drugs

Efficacy of drug	Groups		Total	p-value
	Metered Dose Inhaler	Dry Powder Inhaler		
Yes	162	126	288	0.0004
	70.7%	55.0%	62.9%	
No	67	103	170	
	29.3%	45.0%	37.1%	
Total	229	229	458	
	100.0%	100.0%	100.0%	

Table 5: Stratification with respect to gender for comparison of efficacy of both drugs

Gender	Efficacy of drug	Groups		Total	p-value
		Metered Dose Inhaler	Dry Powder Inhaler		
Male	Yes	122	79	201	0.00004
		74.4%	52.3%	63.8%	
	No	42	72	114	
		25.6%	47.7%	36.2%	
Total		164	151	315	
		100.0%	100.0%	100.0%	
Female	Yes	40	47	87	0.876
		61.5%	60.3%	60.8%	
	No	25	31	56	
		38.5%	39.7%	39.2%	
Total		65	78	143	
		100.0%	100.0%	100.0%	

Table 6: Stratification with respect to age for comparison of efficacy of both drugs

Age groups	Efficacy of drug	Groups		Total	p-value
		Metered Dose Inhaler (MDI)	Dry Powder Inhaler (DPI)		
18-30 years	Yes	49	35	84	0.051
		77.8%	61.4%	70.0%	
	No	14	22	36	
		22.2%	38.6%	30.0%	
Total	63	57	120		
	100.0%	100.0%	100.0%		
31-45 years	Yes	48	41	89	0.004
		81.4%	57.7%	68.5%	
	No	11	30	41	
		18.6%	42.3%	31.5%	
Total	59	71	130		
	100.0%	100.0%	100.0%		
>45 years	Yes	65	50	115	0.103
		60.7%	49.5%	55.3%	
	No	42	51	93	
		39.3%	50.5%	44.7%	
Total	107	101	208		
	100.0%	100.0%	100.0%		

Table 7: Stratification with respect to duration of disease for comparison of efficacy of both drugs

Duration of disease	Efficacy of drug	Groups		Total	p-value
		Metered Dose Inhaler (MDI)	Dry Powder Inhaler (DPI)		
upto 1 year	Yes	54	45	99	0.046
		67.5%	52.3%	59.6%	
	No	26	41	67	
		32.5%	47.7%	40.4%	
Total	80	86	166		
	100.0%	100.0%	100.0%		
1-5 years	Yes	58	42	100	0.003
		77.3%	54.5%	65.8%	
	No	17	35	52	
		22.7%	45.5%	34.2%	
Total	75	77	152		
	100.0%	100.0%	100.0%		
>5 years	Yes	50	39	89	0.298
		67.6%	59.1%	63.6%	
	No	24	27	51	
		32.4%	40.9%	36.4%	
Total	74	66	140		
	100.0%	100.0%	100.0%		

Age range in this study was from 18 to 70 years with mean age of 44.4±6.29 years. The mean age of patients in group A was 41.3±6.6 years and in group B was 40.3±6.3 years. Mean duration of disease was 5.38±2.86 years. The mean duration of

disease in group A was 6.4±2.6 years and in group B was 7.6±2.7 years.

Efficacy was found in 162(70.7%) patients in group-A (Metered Dose Inhaler) while in 126(55.0%) patients in group-B (Dry Powder Inhaler) with p-value of 0.0004 which is statistically significant.

DISCUSSION

Current trial examined in patients with asthma of ages between 18-70 years, showed that a month of treatment with two medications was successful for enhancing pneumonic capacity and was commonly very much endured. Following a month of treatment, the patients who got MDI had altogether more prominent pattern balanced FEV1 contrasted and the individuals who got DPI.

In an ongoing report examined, MDI gave comparative upgrades in aspiratory work contrasted and DPI when regulated as a solitary 90 or 180 µg doses.¹¹ More patients treated with MDI (70.7%) than patients who got DPI (55.0%) reacted to treatment, as evaluated by the level of patients who accomplished a 15% elevation in FEV1 from pattern inside 30 minutes subsequent to dosing.

The middle time to accomplish this reaction was quick, with a middle time to beginning of 6-9 minutes for an expansion of 15% in FEV1 from pattern inside 30 minutes of dosing. The enhancements from pattern in FEV1 noted in the patients treated with MDI were comparable on day 1 and on day 22, which showed that there was no tachyphylaxis because of incessant albuterol use over the 3-week ponder period.

The upgrades noted on day 1 demonstrated the viability of MDI as a rescue inhaler on an as-required reason for fast alleviation, while the proceeded with adequacy noted on day 22 showed that patients would keep on encountering advantage even after rehashed utilize. Albeit past outcomes demonstrate that perpetual utilization of β agonists in asthma may result in more intensifications, the present examination did not watch an expansion because of MDI treatment in correlation with placebo treatment.¹²

In recent study, almost 100% of patients were already taking prescription for obstructive airway illness. It might be a plausibility that these corresponding drugs gave some dimension of insurance from tachyphylaxis. The multiple times day by day administration of MDI and DPI over a month treatment duration was all around endured among pediatric patients, with equivalent mediocrity profiles between the treatment groups. Quite, multiple times every day dosing isn't the prescribed dosing plan; all the more regularly, as-required dosing is utilized in clinical practice.

Any AEs or lessening of impact would almost certainly be substantially less with the less incessant dosing utilized in reality setting. The general frequency of treatment-new AEs was ≤4%. There were no genuine AEs, and none of the occasions was viewed as treatment related. Nine patients experienced asthma intensifications; eight of the nine cases recuperated or were recouping.

These results were commonly predictable with the realized mediocrity profile of albuterol and other short-acting β_2 -adrenergic agonists and steady with two recently reported researches in adults on the tolerability of albuterol MDPI managed multiple times day by day for an aggregate day by day portion of 720 μg over a 3 months duration.¹³

In one study by Miyahara H et al, Measurements done after DPI and MDI therapies, FEV₁ 84.1 \pm 16.3% versus 91.5 \pm 18.2%.⁷ This study was done in pediatric population. High helpful adequacy was acquired with the utilization of the MDI in formoterol inhalation for post-grade school age patients with adequate motivation capacity.

For the treatment of bronchial asthma, two sorts of formoterol inhaler gadgets are accessible, in particular, metered-portion inhaler (MDI) and dry powder inhaler (DPI). The previous is suggested for children with a low pinnacle inspiratory stream.⁷ It was seen that a minimal improvement of FEV₁ of 230 ml is reported as an improvement by patients, however, between 400 to 500 ml, 90% of asthmatics report improvement.⁸ The efficacy of MDI and DPI was 58% and 51% respectively.⁹ Efficacy of MDI was 62.5%.¹⁰

CONCLUSION





Metered Dose Inhaler (MDI) provides significant improvements in FEV₁ versus Dry Powder Inhaler (DPI).

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