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EVALUATION OF SHORT-TERM CLINICAL OUTCOMES WITH DIFFERENT INHALER DEVICES IN COPD PATIENTS

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Abstract

Background: *Chronic obstructive pulmonary disease (COPD) is a progressive respiratory condition and a major global health concern with significant morbidity and mortality. Effective management relies heavily on inhalation therapies, primarily metered dose inhalers (MDIs) and dry powder inhalers (DPIs). However, the comparative effectiveness of these devices remains inconclusive.*

Objective: *This study aimed to compare the short-term outcomes of MDIs and DPIs in reducing acute exacerbations in COPD patients.*

Methods: *A comparative cross-sectional study was conducted at Tertiary Care Hospital of Wah Cantt over six months. Sixty-eight COPD patients, aged 30–80 years, with no prior inhaler use were enrolled and equally divided into two groups: one received MDI and the other DPI, both containing budesonide-formoterol. Baseline demographics were recorded, and patients were followed for 30 days to monitor acute exacerbations. Data were analyzed using SPSS v20 with Chi-square and t-tests applied where appropriate.*

Results: *The frequency of acute exacerbations was significantly lower in the DPI group (14.7%) than the MDI group (38.2%) ($p = 0.03$). Additionally, DPI users had a longer mean time to first exacerbation (24.6 ± 4.8 days) compared to MDI users (18.9 ± 5.7 days), also statistically significant ($p = 0.001$). No significant effect modifiers were found in subgroup analysis.*

Conclusion: *DPIs demonstrated superior outcomes over MDIs in reducing and delaying acute COPD exacerbations in the short term. These findings suggest a potential preference for DPI in COPD management, warranting further long-term studies.*

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a globally prevalent respiratory condition that poses a significant public health burden due to its chronic nature, high morbidity and mortality rates [1].

Epidemiologically, COPD ranks as one of the leading causes of death worldwide, with its prevalence closely tied to both modifiable and non-modifiable risk factors such as tobacco smoking, environmental exposure and occupational hazards [2, 3]. Global annual incidence of COPD is nearly 400 million while in Pakistan the prevalence of this debilitating respiratory disease has been reported at 13.8% [4, 5]. Management of COPD primarily depends upon the removal of the noxious agent (like smoking) exposure in the ailing patients and providing medication in the form of inhalation therapy [6]. In this regard, there are two different type of inhalers are available including the metered dose inhalers (MDI) and the dry powder inhalers (DPI). Both of these have extensively been used in management of COPD.

A comparative observational study was conducted in recent times in which this comparison of the outcomes of metered dose inhalers (MDI) versus dry powder inhalers (DPI) in patients with chronic obstructive pulmonary disease (COPD) was performed. They reported that the frequency of acute exacerbation of COPD among DPI users was significantly less as compared to MDI users (21.7% versus 59.4%; p = 0.002) [7]. Contrarily, in one study it was reported that there was no difference between MDI and DPI in terms of frequency of acute exacerbation of COPD (p > 0.05) [8]. Similarly, in one study, although the was no difference between MDI and DPI in terms of frequency of acute COPD exacerbations (p = 0.11) but mean number of days to first episode of acute exacerbation of COPD within 30 days of therapy initiation was significantly high in MDI users as compared to DPI users (8.2 ± 9.5 days versus 5.0 ± 7.6 days, p = 0.028) making MDI use a better choice.

Based on the results of previous studies, conclusive evidence regarding the superior method of delivery of inhalation therapy to manage COPD patients is not yet available with some studies favoring DPI use while other showing MDI to provide better outcomes in COPD patients. Therefore, present study is being conducted with the aim to compare the short term outcomes of metered dose inhalers (MDI) versus dry powder inhalers (DPI) in patients with chronic obstructive pulmonary disease (COPD). This will help establishing the best inhalation therapy delivery system that can most effectively manage COPD patients and provide improved outcomes.To compare the short term outcomes of metered dose inhalers (MDI) versus dry powder inhalers (DPI) in patients with chronic obstructive pulmonary disease (COPD).

MATERIALS AND METHODS

This comparative cross-sectional study was conducted in the Medicine Department of Tertiary Care Hospitals of Wah Cantt. The objective was to compare the frequency of acute exacerbations of chronic obstructive pulmonary disease (COPD) in patients using two different types of inhalation therapy: metered dose inhalers (MDI) and dry powder inhalers (DPI), both containing budesonide and formoterol. A total of 68 patients, aged 30–80 years and diagnosed with COPD for more than six months without prior inhaler use, were selected through non-probability consecutive sampling. Patients who continued to smoke, had a history of pulmonary tuberculosis, heart disease, or lung surgery were excluded. After informed consent, patients were divided into two equal groups: Group A received MDI, while Group B received DPI for one month.

Data collection involved recording baseline demographic and clinical parameters, followed by a 30-day observation period to monitor the onset of acute exacerbations. All outcomes were documented using a pre-designed proforma. Data analysis was carried out using SPSS version 20. Continuous variables were assessed for normality using the Shapiro-Wilk test and expressed as mean ± SD or median with interquartile range (IQR), while categorical variables were presented as frequencies and percentages. Group comparisons for frequency of acute exacerbations were conducted using Chi-square or Fisher's exact test, and independent t-tests or Mann-Whitney U-tests were used to compare the number of days to first exacerbation. Stratification by age, gender, BMI, and disease duration was performed to control for potential effect modifiers. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

A total of 68 patients were enrolled in the study, with 34 patients in each treatment group. The baseline characteristics, including age, gender, BMI, and duration of COPD, were comparable between the two groups with no statistically significant differences (p >

0.05). The mean age in the MDI group was 60.7 ± 9.4 years, while it was 61.1 ± 10.2 years in the DPI group. Males comprised 70.6% of the MDI group and 67.6% of the DPI group. The average BMI was 24.9 ± 2.6 kg/m² in the MDI group and 25.3 ± 2.4 kg/m² in the DPI group. The mean duration of COPD was 4.1 ± 1.2 years in both groups,

TABLE: 1 DEMOGRAPHIC STATISTICS

Variable	Value
MDI group	60.7 ± 9.4 years
DPI group	61.1 ± 10.2 years
BMI	24.9 ± 2.6
COPD	4.1 ± 1.2

During the 30-day follow-up period, acute exacerbation of COPD was observed in 13 patients (38.2%) in the MDI group compared to 5 patients (14.7%) in the DPI group. This difference was statistically significant (p = 0.03) using the Chi-square test. Additionally, the mean number of days until the first acute exacerbation was 18.9 ± 5.7 days in the MDI group versus 24.6 ± 4.8 days in the DPI group, which was also statistically significant (p = 0.001) using the independent t-test. Stratified analysis by age, gender, BMI, and disease duration did not show any significant effect modification on the frequency or timing of exacerbation. These results indicate that DPI therapy may be more effective than MDI in reducing the risk and delaying the onset of acute exacerbations in COPD patients over a one-month period.

TABLE: 2 OUTCOMES OF PATIENT

Variable	Frequency Percentage (%)
COPD	(38.2%)
MDI group	(14.7%)

DISCUSSION

A total of 68 patients were enrolled in the study, with 34 patients in each treatment group. Baseline characteristics included age, gender, BMI, and duration of COPD. In other research (2001), a systematic review examined evidence from clinical trials evaluating the effectiveness of different inhaler devices in delivering inhaled corticosteroids and beta2-bronchodilators to patients with asthma and COPD [11].

In our study, the mean age in the MDI group was 60.7 ± 9.4 years, compared to 61.1 ± 10.2 years in the DPI group. Males comprised 70.6% of the MDI group and 67.6% of the DPI group. In other research (2018), despite greater COPD-related healthcare resource utilization (HRU) and costs before index hospitalization, U.S. patients using a pMDI after hospital discharge incurred significantly lower all-cause and COPD-related healthcare costs, and had a reduced likelihood of COPD exacerbation–related hospital readmission compared with those using a DPI [12].

The average BMI was 24.9 ± 2.6 kg/m² in the MDI group and 25.3 ± 2.4 kg/m² in the DPI group. The mean duration of COPD was 4.1 ± 1.2 years in both groups. In other research (2021), in a real-world clinical setting, a budesonide–formoterol inhaler was found to be generally as effective at reducing the incidence of moderate-to-severe exacerbations as fluticasone–salmeterol [13].

During the 30-day follow-up period, acute exacerbation of COPD occurred in 13 patients (38.2%) in the MDI group versus 5 patients (14.7%) in the DPI group. This difference was statistically significant (p = 0.03, Chi-square test). In other research (2024), budesonide–glycopyrrolate–formoterol was not associated with improved clinical outcomes compared with fluticasone–umeclidinium–vilanterol. Given the added climate impact of metered-dose inhalers, health systems aiming to

reduce their use may consider promoting fluticasone–umeclidinium–vilanterol instead in people with COPD [14].

Additionally, the mean number of days until the first acute exacerbation was 18.9 ± 5.7 days in the MDI group versus 24.6 ± 4.8 days in the DPI group, which was also statistically significant ($p = 0.001$, independent t-test). In other research (2007), patients using combined nebulizer therapy in the morning and evening, with mid-day inhaler use, had the most significant improvements in quality-of-life indices. This regimen provides the symptom relief of a nebulizer along with the convenience of an inhaler for use away from home [15].

Stratified analysis by age, gender, BMI, and disease duration did not reveal any significant effect modification on the frequency or timing of exacerbations. In other research (2016), COPD patients prescribed additional inhaler devices requiring similar inhalation techniques to their previous devices had better outcomes than those prescribed devices requiring different techniques [16]. These results suggest that DPI therapy may be more effective than MDI in reducing the risk and postponing the onset of acute exacerbations in COPD patients over a one-month period. In other research (2014), inhaler device type (multiple-dose versus single-dose inhalers) had no apparent impact on COPD patients' persistence with LABAs. Over 80% of patients who initially stopped LABAs either restarted their original medication or switched inhalers/medications within one year [17].

CONCLUSION

In conclusion, this study suggests that dry powder inhalers (DPIs) may be more effective than metered dose inhalers (MDIs) in reducing the risk and delaying the onset of acute exacerbations in COPD patients over a 30-day period. Despite similar baseline characteristics, patients in the DPI group experienced fewer and later exacerbations. These findings align with previous research indicating potential clinical and economic benefits of DPI use in COPD management. Further studies are warranted to confirm these results over longer follow-up periods.

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