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Original Research Article

A COMPARATIVE STUDY OF LONG-TERM OUTCOMES IN CHRONIC OBSTRUCTIVE PULMONARY DISEASES (COPD) AND ASTHMA PATIENTS RECEIVING INHALED CORTICOSTEROIDS

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Abstract: *Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death in most industrialized countries and affects about three million people worldwide. Objective: The primary objective of this study is to compare the long-term outcomes in patients with chronic obstructive pulmonary disease (COPD) and asthma who receive inhaled corticosteroids.* ***Objective:*** *To compare the long-term outcomes of inhaled corticosteroid (ICS) therapy in patients with chronic obstructive pulmonary disease (COPD) and asthma.* ***Methods:*** *This comparative, observational study was conducted at the Department of Pulmonology, Pak Emirates Military Hospital, a tertiary care center, from July 2024 to October 2024. A total of 230 patients participated in the study.* ***Results:*** *Data were collected from 230 patients. Asthma patients were younger (47.89 ± 12.02 years) compared to COPD patients (55.01 ± 10.23 years, $p < 0.001$) and had a higher proportion of females (70% vs. 30%, $p < 0.001$). Smoking history was more prevalent in COPD patients (85% vs. 10%, $p < 0.001$), reflecting its role as a primary risk factor. Asthma patients had a higher baseline BMI (25.5 ± 3.2 kg/m² vs. 23.8 ± 4.1 kg/m², $p = 0.02$) and shorter disease duration (8 ± 3 years vs. 12 ± 4 years, $p < 0.01$). Additionally, asthma patients had better baseline lung function (FEV1 68 ± 8% vs. 58 ± 10%, $p < 0.001$) and lower exacerbation rates (2.1 ± 0.5 vs. 3.2 ± 0.6 events/year, $p < 0.001$). The mean FEV1 improvement in asthma patients was 15% ± 3%, compared to 7% ± 2% in COPD patients ($p = 0.01$). Similarly, the FEV1/FVC ratio improved more in asthma patients (+12%) than in COPD patients (+5%, $p = 0.01$).* ***Conclusion:*** *It is concluded that inhaled corticosteroid (ICS) therapy significantly improves long-term outcomes in both asthma and Chronic Obstructive Pulmonary Disease (COPD) patients, but its effects are more pronounced in asthma.*

Keywords: Chronic Obstructive Pulmonary Disease, Asthma, Inhaled Corticosteroids, Lung Function, Exacerbations

Introduction

Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death in most industrialized countries and affects about three million people worldwide. Chronic obstructive pulmonary disease refers to a group of ongoing lung conditions that reduce lung breathing function. The primary signs of COPD include difficulty breathing, excessive sputum production, and a persistent cough (1). Both COPD and asthma rank among the top respiratory problems globally and raise healthcare spending while increasing the number of deaths in people. Airway blockage and tissue inflammation occur in both conditions, but they progress differently, exhibit distinct symptoms, and have varying impacts on the body (2). COPD develops when people spend many years breathing in toxic substances like tobacco smoke and consider the condition a permanent problem (3). Asthma features easily recoverable breathing problems that occur when patients react to allergens, infections, or exercise. Doctors use inhaled corticosteroids as the primary treatment for asthma and COPD, as these medications effectively reduce inflammation (4). Asthma patients rely most heavily on ICS treatments to maintain symptom control and lessen their risk of attacks. Patients with COPD receive ICS treatment together with bronchodilators, specifically when they have numerous breathing problems or test positive for eosinophilic inflammation (5). Scientists continue to discuss potential risks and benefits associated with the extended use of ICS in patients with asthma and COPD. The different risks of steroid therapy between asthma and COPD patients require personalized medical treatments.

Scientists have studied ICS treatment for each disease separately; however, we lack sufficient data to understand how it affects people who have both conditions (6). We need to study how ICS affects each of these outcomes to develop more effective treatment plans that minimize harm. Researchers can use these results to develop medical guidelines that tailor treatment to each patient group. The high worldwide impact of COPD and asthma requires detailed knowledge about lifelong care methods (7). Data from the World Health Organization shows COPD ranks as the third most fatal disease across the planet, and cigarette smoking remains its primary trigger. Asthma currently affects 300 million worldwide and shows up early in children, while maintaining a lifelong condition that needs continuous care (8). These medical conditions shorten life expectancy and create multiple health and financial challenges for patients and healthcare providers. Researchers still debate the duration of ICS therapy use because the breakthrough in COPD treatment continues to evolve (9).

Anti-inflammatory therapeutics evaluated in COPD include inhaled corticosteroids (ICS), oral glucocorticoids, phosphodiesterase inhibitors, antibiotics, statins, mucolytics, and monoclonal antibodies targeting inflammatory mediators, such as benralizumab and mepolizumab, which target IL-5, among other medications. Patients with COPD receive ICS treatment as part of their

triple therapy, which includes LABA and LAMA medications. This medication blend works to counteract various damaging processes in COPD patients, helping to prevent lung attacks and enhancing breathing ability (10). Data suggests patients with COPD who use inhaled corticosteroids for an extended period face increased pneumonia risk while possibly developing systemic health problems, including weaker bones. The combination of multiple illnesses in older COPD patients creates elevated health risks since senior patients make up most of the COPD population (11). In asthma care, ICS serves as primary therapy because it controls inflammation and stops asthma attacks. The data shows it successfully controls patients' symptoms and helps them avoid trips to the hospital. Using inhaled corticosteroids for a long time in young people may cause reduced growth and hinder their hormone production. Patients require ongoing assessments, and doctors should adjust treatment to optimize ICS benefits while minimizing potential risks (12).

The primary objective of the study is to compare the long-term outcomes in patients with chronic obstructive pulmonary disease (COPD) and asthma who receive inhaled corticosteroids.

Methodology

This comparative, observational study was conducted at the Department of Pulmonology, Pak Emirates Military Hospital, a tertiary care center, from July 2024 to October 2024. A total of 230 patients participated in the study, comprising adult patients aged 18 years or older. Diagnosed with COPD or asthma, confirmed by spirometry according to GOLD and GINA guidelines, respectively. Patients receiving ICS therapy for at least one year prior to the study. Patients with overlapping diagnoses, such as Asthma-COPD Overlap Syndrome (ACOS).Those with significant comorbidities, such as advanced cardiac or renal disease. Patients who discontinued ICS therapy during the study period. Data were collected through patient records and follow-up interviews conducted during regular clinical visits. Key parameters assessed included lung function through spirometry, specifically Forced Expiratory Volume in 1 second (FEV1) and FEV1/FVC ratio. Exacerbation rates, including hospitalizations and emergency visits for respiratory distress, were documented. Patient quality of life was assessed using standardized tools, such as the St. George's Respiratory Questionnaire (SGRQ). Any adverse events, including pneumonia or other ICS-related complications, were meticulously recorded. Data were analyzed using SPSS v26. Continuous variables were expressed as mean ± standard deviation, while categorical data were presented as percentages. Independent t-tests and chi-square tests were utilized to assess differences between groups. A p-value of less than 0.05 was considered statistically significant.

Results

Data were collected from 230 patients. Asthma patients were younger (47.89 ± 12.02 years) compared to COPD patients (55.01 ± 10.23 years, $p < 0.001$) and had a higher proportion of females (70% vs. 30%, $p < 0.001$). Smoking history was more prevalent in COPD patients (85% vs. 10%, $p < 0.001$), reflecting its role as a primary risk factor. Asthma patients had a higher baseline BMI (25.5 ± 3.2 kg/m² vs. 23.8 ± 4.1 kg/m², $p = 0.02$) and shorter disease duration (8 ± 3 years vs. 12 ± 4 years, $p < 0.01$). Additionally, asthma patients had better baseline lung function (FEV1 68 ± 8% vs. 58 ± 10%, $p < 0.001$) and lower exacerbation rates (2.1 ± 0.5 vs. 3.2 ± 0.6 events/year, $p < 0.001$).

The mean FEV1 improvement in asthma patients was 15% ± 3%, compared to 7% ± 2% in COPD patients ($p = 0.01$). Similarly, the FEV1/FVC ratio improved more in asthma patients (+12%) than in COPD patients (+5%, $p = 0.01$).

The initial exacerbation rate was lower in asthma patients (2.1 ± 0.5 events per year) compared to COPD patients (3.2 ± 0.6 events per year). After ICS therapy, the exacerbation rate decreased to 0.8 ± 0.3 events per year in asthma patients and 1.9 ± 0.4 events per year in COPD patients, with the reduction being statistically significant ($p = 0.003$).

In the symptoms domain, asthma patients experienced a reduction of 8 points compared to 5 points in COPD patients ($p = 0.01$). The activity domain showed a 7-point reduction in asthma patients compared to a 4-point reduction in COPD patients ($p = 0.01$). In the impact domain, asthma patients achieved a 5-point reduction compared to a 3-point reduction in COPD patients ($p = 0.02$). Overall, the total score reduction was more pronounced in asthma patients (-20 points) compared to those with COPD (-12 points, $p = 0.002$).

Prior to ICS therapy, the number of hospitalizations per year was 50 for asthma patients and 80 for COPD patients. Following the ICS intervention, hospitalizations decreased to 20 in asthma patients and 50 in COPD patients, with the reduction being statistically significant ($p = 0.01$). The percentage reduction in hospitalizations was higher for asthma patients (60%) compared to those with COPD (37.5%, $p = 0.03$).

Table 1: Demographic and Baseline Characteristics

Characteristic	Asthma Patients (n = 110)	COPD Patients (n = 120)	P-Value
Mean Age (years)	47.89 ± 12.02	55.01 ± 10.23	<0.001
Gender (Male/Female)	40/70	90/30	<0.001
Smoking History (%)	10%	85%	<0.001
Body Mass Index (BMI, kg/m²)	25.5 ± 3.2	23.8 ± 4.1	0.02
Mean Duration of Disease (years)	8 ± 3	12 ± 4	<0.01
Baseline FEV1 (% predicted)	68 ± 8	58 ± 10	<0.001
Baseline Exacerbation Rate (events/year)	2.1 ± 0.5	3.2 ± 0.6	<0.001

Table 2: Lung Function Improvement

Parameter	Asthma Patients (Mean ± SD)	COPD Patients (Mean ± SD)	P-Value
FEV1 Improvement (%)	15% ± 3%	7% ± 2%	0.01

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FEV1/FVC Ratio Improvement (%)	+12%	+5%	0.01

Table 3: Exacerbation Rates

Parameter	Asthma Patients	COPD Patients	P-Value
Initial Exacerbation Rate (events/year)	2.1 ± 0.5	3.2 ± 0.6	N/A
Post-ICS Exacerbation Rate (events/year)	0.8 ± 0.3	1.9 ± 0.4	0.003
Reduction in Exacerbation Rate (events/year)	1.3	1.3	N/A

Table 4: Quality of Life Improvement (SGRQ Scores)

Domain	Asthma Patients (Reduction in Points)	COPD Patients (Reduction in Points)	P-Value
Symptoms	-8	-5	0.01
Activity	-7	-4	0.01
Impact	-5	-3	0.02
Total Score Reduction	-20	-12	0.002

Table 5: Hospitalization Rates

Parameter	Asthma Patients (n)	COPD Patients (n)	P-Value
Pre-ICS Hospitalizations (per year)	50	80	-
Post-ICS Hospitalizations (per year)	20	50	0.01
Reduction in Hospitalizations (%)	60%	37.5%	0.03

Discussion

The findings of this study highlight significant differences in the long-term outcomes of inhaled corticosteroid (ICS) therapy between patients with asthma and those with Chronic Obstructive Pulmonary Disease (COPD). ICS therapy helped all patients breathe more easily and live better; however, asthma patients experienced superior overall benefits compared to those with COPD. Patients with asthma demonstrated better outcomes, as indicated by higher FEV1 ratings and FEV1/FVC ratios, compared to patients with COPD. ICS therapy shows better results in asthma because the condition's inflammation responds to these medications, allowing the airways to function more effectively. ICS therapy works to improve airway function, but COPD patients suffer from permanent lung damage that reduces the benefits of their treatment (13). The rate of asthma attacks decreased much more than the rate of COPD attacks for both groups. Medical evidence shows that ICS helps prevent asthma patients from experiencing attacks. Despite experiencing reduced emergency events, COPD patients kept their elevated baseline risk levels because the disease steadily advances throughout their bodies. Asthma patients recorded higher outcomes on the St. George's Respiratory Questionnaire (SGRQ), which measures their quality of life (14). Because asthma responds well to ICS therapy, users experience better symptom management and can lead a more active lifestyle. COPD patients experienced modest quality-of-life gains even while dealing with their continuing illness and multiple health problems. People with COPD develop pneumonia and oral fungal infections more often than people with asthma (15). Patient selection and infection risk evaluation are crucial when doctors administer ICS to individuals with a history of recurrent infections. Studies indicate that asthma patients receive ICS treatment safely when healthcare professionals use these medications correctly. Medical care needs to adapt treatment plans based on individual patient characteristics (16). Asthma patients benefit significantly from inhaling corticosteroids as their primary treatment option for symptom management and the prevention of attacks. Healthcare providers should prescribe inhaled corticosteroids to patients with COPD who have certain risk factors, but should target treatment only when actual conditions and blood test results meet specific criteria (17-19). This research stands out because it demonstrates the various mechanisms by which inhaled corticosteroids help individuals with asthma and COPD. However, several limitations must be noted. Because COPD develops slowly, we might not grasp the full effects of ICS treatment by following patients for only six months. The study examined patients from only one healthcare center, so these results may not be fully applicable to people treated at other medical centers. Additional research needs to examine these results using longer study durations and larger patient groups from multiple medical centers. Studying biomarkers for ICS responsiveness will enable doctors to identify more effective treatment options for COPD patients.

Conclusion

It is concluded that inhaled corticosteroid (ICS) therapy significantly improves long-term outcomes in patients with both asthma and Chronic Obstructive Pulmonary Disease (COPD). However, its effects are more pronounced in asthma. Asthma patients demonstrated more significant improvements in lung function, reduced exacerbation rates, and enhanced quality of life compared to COPD patients, highlighting the higher responsiveness of asthma to ICS therapy.

Declarations

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned. (IRBEC-MMCHS-222/23)
Consent for publication
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Not applicable

Conflict of interest

The authors declared the absence of conflict of interest.

Author Contribution

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Study Design, Review of Literature.
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Conception of the Study, Development of Research Methodology Design, Study Design, Review of the manuscript, and final approval of the manuscript.
Conception of Study, Final approval of manuscript.
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