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EVALUATION OF INFLAMMATORY BIOMARKERS AND THERAPEUTIC INTERVENTIONS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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ABSTRACT

Aim: to evaluate the effectiveness of different therapeutic interventions in reducing systemic inflammation and improving clinical outcomes in COPD patients.

Materials and Methods: The study included 130 participants, comprising 110 patients diagnosed with COPD and 20 healthy individuals as controls. The COPD patients were divided into groups: Group 1 (53 patients, categorized under A and B) and Group 2 (57 patients, categorized under C and D). All participants underwent clinical examinations, lung function assessments, and biomarker analysis at baseline and three-month intervals.

Results: Group 1 patients exhibited significantly higher leukocyte counts and pro-inflammatory cytokine levels before treatment than Group 2 ($p<0.05$). However, CRP levels were twice as high in Group 2 compared to Group 1. A correlation was found between CRP levels, ventilation impairments, and the annual exacerbation rate (AER). After treatment, a significant reduction in inflammatory biomarkers was observed, particularly in Subgroup 1A. Leukocyte count in Subgroup 1A decreased by 13.5% compared to Subgroup 1B, while in Group 2, leukocyte reduction was not statistically significant ($p > 0.05$). The results suggest that patients in Subgroup 1A experienced a more effective reduction in systemic inflammation than those in Subgroup 1B, demonstrating a superior response to the treatment regimen.

Conclusion: The study highlights the importance of targeted therapeutic interventions in managing COPD-related inflammation. However, inflammatory markers remained elevated despite improvements compared to healthy individuals, indicating persistent latent inflammation. These results underscore the necessity for continued anti-inflammatory strategies to optimize COPD management and reduce disease progression.

Key words: Chronic obstructive pulmonary disease, inflammation, biomarkers, spirometry, PDE-3 inhibitors, randomized controlled study, systemic inflammation, therapeutic intervention.

INTRODUCTION

Chronic obstructive pulmonary disease has become one of the leading causes of morbidity and mortality worldwide. Recurrent exacerbations mark this condition and are often challenging to treat effectively [5]. Comparative studies using X-ray imaging and, more recently, biopsy analysis in treating thousands of patients have demonstrated that the diagnostic error rate in specialized medical centers is around 4–5% and continues to decline. The proper application of standardized diagnostic methods, particularly spirometry, by general practitioners in non-specialized settings can improve the accuracy of COPD diagnoses to approximately 80–85%. Additionally, implementing various biopsy techniques in specialized pulmonology centers increases diagnostic accuracy to 95–96% [2,3]. Clinical observations indicate that general practitioners frequently diagnose COPD based on subjective symptoms such as shortness of breath, physical examination findings, and radiographic data. This is especially common in patients with recurrent lung disease exacerbations, often without sufficient consideration of the risk factors contributing to the onset and progression of COPD [7]. Spirometry for diagnosing COPD has gained increasing recognition over the years. Currently, COPD classification relies on post-bronchodilation forced expiratory volume in one second (FEV1) as the primary indicator of disease severity. Over the past decade, research has reinforced the crucial role of FEV1 in COPD diagnosis. However, in recent years, concerns have been raised about potential overdiagnosis, particularly when attempting to account for minor or difficult-to-measure symptoms, which may lead to misclassification of the disease [4]. Chronic obstructive pulmonary disease (COPD) is a progressive respiratory condition characterized by persistent airflow limitation and systemic inflammation. It significantly impacts patients' quality of life and increases morbidity and mortality rates [1]. The pathogenesis of COPD involves a complex interplay of oxidative stress, inflammation, and structural lung changes, often exacerbated by environmental and genetic [6]. Despite advancements in therapeutic strategies, inflammation remains a crucial target in COPD management to reduce exacerbations and disease progression [8]. The work aims to evaluate the effectiveness of different therapeutic interventions in reducing systemic inflammation and improving clinical outcomes in COPD patients.

MATERIAL AND METHODS OF RESEARCH

The study included 130 participants, 110 patients diagnosed with COPD, and 20 healthy individuals. The COPD patients were divided into groups: Group 1 (53 patients), classified under categories A and B, and Group 2 (57 patients), classified

under categories C and D. The study was conducted as a randomized controlled trial over 12 months. All participants underwent clinical examinations, lung function tests, and biomarker assessments at baseline and three-month intervals. Spirometry was performed to assess FEV1 and FEV1/FVC ratios. Blood samples were collected to analyze CRP, TNF-α, IL-6, and IL-8 levels. Statistical analysis was conducted using SPSS software; results were considered significant at $p<0.05$.

RESULTS AND DISCUSSION

According to the results, Group 1 patients exhibited significantly higher leukocyte counts and pro-inflammatory cytokine levels before treatment than Group 2 ($p<0.05$). However, CRP levels were twice as high in Group 2 compared to Group 1. A correlation was found between CRP levels, ventilation impairments, and the annual exacerbation rate (AER). After treatment, a significant reduction in inflammatory biomarkers was observed, particularly in Subgroup 1A, highlighting the effectiveness of the treatment approach in this group. Leukocyte count in Subgroup 1A decreased by 13.5% compared to Subgroup 1B, whereas leukocyte reduction was not statistically significant in both subgroups of Group 2 ($p > 0.05$). This indicates a stronger anti-inflammatory response in Subgroup 1A. CRP levels, a key marker of systemic inflammation, showed a notable decrease of 13% in Subgroup 1A. In contrast, the reduction in Subgroup 1B was only 6%, with statistical significance ($p < 0.05$), suggesting a more substantial improvement in inflammation control in Subgroup 1A. Similarly, TNF-α levels, another important inflammatory marker, were reduced by 11.5% in Subgroup 1A, compared to a smaller 6% decrease in Subgroup 1B. The most pronounced difference was observed in IL-6 levels, where Subgroup 1A experienced a substantial reduction of 35.9%, reaching 14.5 pg/ml, while the decrease in Subgroup 1B was less significant ($p < 0.05$). These results demonstrate that patients in Subgroup 1A experienced a more effective reduction in systemic inflammation than Subgroup 1B, indicating a superior response to the treatment protocol applied to this group. The lack of significant leukocyte reduction in Group 2 suggests that the inflammatory burden remained more persistent in these patients, necessitating further therapeutic considerations.

Discussion: After six and twelve months of PDE-3 inhibitor therapy, a significant reduction in systemic inflammation markers was observed in COPD patients. In Subgroup 1A, IL-6 levels decreased significantly from the first month of treatment to the sixth month and remained stable for up to 12 months, while in Subgroup 1B, IL-6 levels did not show a consistent decline. Similarly, CRP and TNF-α levels demonstrated significant reductions in Subgroup 1A but remained elevated in Subgroup 1B. Treatment effects began to appear after six months

among high-risk COPD patients (Group 2). By the twelfth month, systemic inflammation markers significantly differed between Subgroup 2A (PDE-3 inhibitor) and Subgroup 2B (bronchodilator therapy only).

CONCLUSION

The results suggest that in low-risk COPD patients, PDE-3 inhibitors show treatment efficacy after one month and maintain effectiveness for up to 12 months. In high-risk COPD patients, significant treatment effects appear after six months, with continued improvements over 12 months. However, systemic inflammation markers in all COPD patients remained higher than healthy individuals, indicating persistent latent inflammation despite therapy. These findings highlight the need for continued anti-inflammatory treatment strategies for COPD patients.

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