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Mini Review

The Significance of Parathyroid Hormone and Vitamin D Values in Patients with Chronic Obstructive Pulmonary Disease-Mini Review

Zovko Tanja[1,2*], Galic Kristina[1,2], Pravdic Danijel[2,3]

[1]Department of Lung Diseases and Tuberculosis, University Clinical Hospital Mostar, Mostar, Bosnia and Herzegovina; [2]Department of Medicine, University of Mostar, Mostar, Bosnia and Herzegovina; [3]Department of Internal Diseases, University Clinical Hospital Mostar, Mostar, Bosnia and Herzegovina

ABSTRACT

To understand and predict Chronic Obstructive Pulmonary Disease (COPD), a biomarker that reflects disease severity, exacerbation risk, and disease prognosis is of most importance. So far, there is an insufficient amount of data about the correlation between PTH and vitamin D changes in COPD with different parameters of lung function and in different stages of COPD.

The primary objective of our study was to determine the disturbances in the concentration of Parathyroid Hormone (PTH) and 25-hydroxyvitamin D (vitamin D) in patients with stable Chronic Obstructive Pulmonary Disease (COPD), and its correlation with airflow obstruction. Therefore, we correlated FVC, FEV1, FEV%FVC, and MEF_{50} values with PTH, vitamin D, calcium, and phosphate levels in patients with COPD.

Keywords: COPD; Parathyroid hormone; Vitamin D; Pulmonary function

INTRODUCTION

In our prospective study, we included 200 patients with a confirmed diagnosis of COPD in the Department of Lung Diseases and Tuberculosis, and the Pulmonology Polyclinic of University Clinical Hospital Mostar in the period of 3 years, between May 2021 and May 2024. Inclusion criteria were: stable phase of COPD, hemodynamically stable patients older than 40 years, EV1/FVC<0.7, patients with PTH, vitamin D, calcium, and phosphate measurements. Exclusion criteria were: Acute exacerbation of COPD in the last month, current treatment with nutritional supplements, vitamins, and statins, lack of availability of lung function data, use of systemic corticosteroids in the previous three months, chronic renal insufficiency, respiratory diseases other than COPD (asthma, pneumonia, tuberculosis, bronchiectasis), and other diseases (cancer, and parathyroid disease). Medical records about demographic data, pulmonary function test (FVC, FEV1, FEV1%FVC, MEF_{50}), Body Mass Index (BMI), COPD Assessment Test (CAT), modified Medical Research Council Dyspnea (mMRC) scale, and serum PTH, vitamin D, calcium, and phosphate levels were obtained.

The results of our study showed that patients with higher COPD stage, had lower spirometry values, the most significantly MEF_{50}. The higher the COPD group (GOLD D), the lower vitamin D and the higher PTH levels were. Calcium and phosphate values were the same for all groups. Vitamin D and PTH levels significantly correlated with MEF_{50} values. The lower MEF_{50} level, the higher PTH levels, and lower vitamin D levels were found (P<0.05).

In conclusion, the patients in the higher COPD group have lower vitamin D levels and higher PTH levels, indicating that they developed secondary hyperparathyroidism. The levels of vitamin D and PTH correlated the most with MEF_{50} values while other spirometry parameters did not significantly correlate with vitamin D and PTH levels.

Correspondence to: Zovko Tanja, Department of Lung Diseases and Tuberculosis, University Clinical Hospital Mostar, Mostar, Bosnia and Herzegovina; E-mail: tanjazovko@net.hr

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LITERATURE REVIEW

Chronic Obstructive Pulmonary Disease (COPD) is the third leading cause of death worldwide, and the main incurable global health problem [1,2]. It is caused by chronic exposure to smoking and/or occupational or environmental factors [3,4]. It is not just a local lung disease but a systemic disease also [5]. Epidemiological studies confirmed the existence of many extrapulmonary comorbidities such as metabolic disorders [6]. To understand and predict the complexity of the pathophysiology of the disease, efforts are made to identify biomarkers that correlate with disease severity. One of the proposed biomarkers is the concentration of serum 25-hydroxyvitamin D (vitamin D) [7]. Its levels correlate with food intake and regulatory mechanisms, such as Parathyroid Hormone (PTH). Vitamin D Deficiency (VDD) is associated with a greater risk of chronic diseases like cancer, autoimmune diseases, cardiovascular diseases, and respiratory diseases [8]. The previous studies show inconsistent results regarding the role of vitamin D in pulmonary function [9]. Deficiency is relatively common and is associated with frequent worsening and reduction of pulmonary function. VDD has also been associated with decreased pulmonary function, increased inflammation, and decreased immunity. COPD poses a high risk for VDD, which is thought to be caused by malnutrition, insufficient outdoor activity, kidney dysfunction, and high catabolism associated with steroid therapy. On the other hand, VDD is also supposed to adversely affect pulmonary functions because, for optimal lung function, vitamin D seems required, beginning from the developmental stages. COPD patients are in a vicious circle of worse lung function due to VDD and decreased vitamin D levels due to COPD. Studies have shown that as a response to low levels of vitamin D, serum PTH is increased in some, but not in all COPD patients.

DISCUSSION

In this prospective study of 200 subjects, we analyzed the association between levels of serum vitamin D, PTH, calcium, phosphate, and COPD severity. The number of patients who die due to the consequences of systemic comorbidities is increasing, more so than from respiratory failure, and metabolic disorders are common extrapulmonary comorbidities. So far, great efforts have been made to identify biomarkers that correlate with disease severity, and one was the concentration of serum vitamin D. Its level is affected by food intake and regulatory mechanisms, such as Parathyroid Hormone (PTH). The association between vitamin D and COPD is not well studied and has yet to be fully investigated. Studies show inconsistent results regarding the role of vitamin D in pulmonary function [9]. Its deficiency is relatively common and is associated with frequent worsening and reduction of pulmonary function. The studies carried out so far suggest that VDD may be a risk factor for respiratory disease and that lower levels of vitamin D are related to reduced levels of pulmonary function measured by Forced Expiratory Volume in One Second (FEV1) and Forced Vital Capacity (FVC). VDD is highly prevalent, but the relation between serum vitamin D levels, and COPD severity is not yet well documented. Also, to our knowledge, there were a few studies that evaluated the relationship between parathyroid hormone, pulmonary function, and COPD. One study reported prevalence of VDD in COPD patients was 89.3%, and secondary hyperparathyroidism associated with VDD was 22.9%. The study done by Park JH and coauthors investigated that PTH values independently correlated with decreased FVC (% predicted) and FEV1 (% predicted) and that vitamin D levels were neither associated with pulmonary function. The results of our study showed that patients in the higher COPD group have lower vitamin D and higher PTH levels. The levels of vitamin D and PTH levels correlated the most with MEF_{50} values. Our results support the thesis that parathyroid hormone is associated with VDD in COPD. In previous studies, vitamin D was regarded as a possible biomarker for COPD. Many recent studies produced controversial results. Until now, studies focused on the role of vitamin D without realizing the impact of PTH in these patients and PTH could be a better biomarker, especially in parts where VDD is in high prevalence. Different complications can develop as a consequence of secondary hyperparathyroidism including osteoporosis, parathyroid hyperplasia, tertiary hyperparathyroidism, immune dysfunction, and different cardiovascular complications. All these effects could further worsen the existing lung disease, moreover, because COPD is a chronic disease, secondary hyperparathyroidism may have a rather long duration. So, monitoring of vitamin D levels should be performed in COPD patients and, if necessary, the vitamin D values corrected.

CONCLUSION

The patients in the higher COPD group have lower vitamin D and higher PTH levels. The levels of vitamin D and PTH levels correlated the most with MEF_{50} values. Our results support the thesis that parathyroid hormone is associated with vitamin D deficiency in COPD patients. Future studies are needed to explore this relationship in more detail, and possible causes of vitamin D deficiency. Recommendations for future authors and researchers are that the results must be investigated in metacentric studies with a higher number of patients coming from different countries and ethnic groups, and other mechanisms included. The reliable biomarkers that can be used as predictors of COPD outcomes should be identified.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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