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Original Research Article

A Hospital Based Observational Assessment of the Relationship between Serum Vitamin D Levels with Acute Exacerbation of COPD and Also Assess the Sociodemographic Profile of These Patients

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Aim: We aimed to assess the relationship between serum vitamin D levels with acute exacerbation of COPD and also assess the sociodemographic profile of these patients.

Methods: This study was carried at Department of Geriatric Patna medical college and Hospital, Patna, Bihar, India. A total of 150 patients admitted with AECOPD were selected consecutively who had given consent and agreed to carry out 25 (OH) D level assays during the period of one year. Finally, 100 patients were included because others were unable to carry out vitamin D assay.

Results: Among them 75 (75%) were males, and 25 (25%) were females. There was male predominance (75%). The mean age of patients in this study was 72.2±13.8 years, with the majority in 65-70 years. The mean 25(OH) D level was 22.03±6.05 ng/ml (95% CI 8.1-40.2). The mean vitamin D level was higher in males (22.06±6.08 ng/ml) than the females (21.93±6.24ng/ml), but the difference failed to reach statistical significance (P= 0.950). The majority of the participants were former smokers (60%), and the mean pack-year of smoking was 22.09±6.14. In this study, vitamin D levels did not differ between smoking groups. Among non-smokers, it is 21.9±8.1 ng/ml, it is 21.4±5.1 ng/ml in those who are current smokers, and 22.3±6.1 ng/ml among Ex-smokers (P= 0.900). The majority (45%) of patients had mMRC Grade -2 dyspnea, followed by 40% in Grade- 1, 10% in Grade-3, and only 5% of patients had Grade- 4 dyspnea (p=0.270). Regarding vocational status, 70% were retired, 10% was house makers, farmers 5%, and rest of the 15% was service holders or business people. The mean level of vitamin D was high among farmers (24.26±2.75ng/ml) compared to other occupational groups.

Conclusion: This study finds a high prevalence of hypovitaminosis D (85%) in AECOPD patients. Vitamin D deficiency and insufficiency are more prevalent in females. In this study, vitamin D levels did not differ between smoking groups.

Keywords: AECOPD, 25(OH) D, Vitamin D.

Introduction

The main reason for Vitamin D deficiency is lack of ultraviolet-B radiation from less sun exposure, and this result in lack of vitamin D production in skin. About 3% of the human genome regulates by vitamin D endocrine system. [1] Vitamin D is currently of great public health interest, because its deficiency is common and is causally associated with musculoskeletal diseases. Half of the world's population is affected by vitamin D insufficiency. [2,3]

According to Janssens et al. [4], vitamin D deficiency occurs in over 60% of patients with severe COPD, and is quantitatively related to disease severity. Epidemiological studies indicate that decreased vitamin D is associated with increased frequency of respiratory infections not only in COPD patients, but also in healthy people. [4,5] This may be due to the involvement of vitamin D in both innate and adaptive immunity regulation. [6,7] A general population study by Skaaby et al. [8], demonstrated a significant inverse association between vitamin D status and death caused by diseases of the respiratory and digestive system and by endocrine, nutritional and metabolic diseases.

Acute exacerbations of COPD (AECOPD) are common and strongly affect disease severity and relative healthcare costs. Vitamin D deficiency is frequent among COPD patients and its role in disease exacerbations is widely debated. By 2030, COPD will be the fourth cause of mortality worldwide. [9] The prevalence of COPD is increasing and this has a substantial influence on healthcare costs, [10] particularly because of frequent disease exacerbations (AECOPD) and hospital admissions. Vitamin D deficiency and insufficiency are common among COPD patients but its contributory role in disease exacerbations is widely debated. According to the available studies, the prevalence of hypovitaminosis D in COPD patients varies between 31–77%. [11] The concentration of vitamin D in COPD patients is reduced when compared to a control group. [12,13] Epidemiological studies indicate that decreased vitamin D is associated with an increased frequency of respiratory infections not only in COPD patients but also in healthy people. [12,14] This may be due to the involvement of vitamin D in both innate and adaptive immunity regulation. [14,15] These findings raise the question of the role of vitamin D deficiency and the benefit of its correction in COPD.

We aimed to assess the relationship between serum vitamin D levels with acute exacerbation of COPD and also assess the sociodemographic profile of these patients and see any difference between different professionals.

Materials and Methods

This study was carried at Department of Geriatric Patna medical college and Hospital, Patna, Bihar, India. A total of 150 patients admitted with AECOPD were selected consecutively who had given consent and agreed to carry out 25 (OH) D level assays during the period of one year. Finally, 100 patients were included because others were unable to carry out vitamin D assay.

The diagnosis of COPD was made according to GOLD (Global Initiative for Chronic Obstructive Lung Disease) criteria.[9] Inclusion criteria were patients with a history of chronic cough with sputum production for the last 2 years admitted with acute exacerbation of symptoms and post bronchodilator ratio of forced expiratory volume in 1 second (FEV1) to forced vital capacity (FVC) <0.7.

Exclusion criteria were Patients or relatives who did not give informed

written consent, did not fulfill clinical or spirometry criteria of acute exacerbation of COPD, and patients who had been treated with vitamin D in either oral or injectable form within the last 3 months. Patients who were previously diagnosed with CKD, CLD, Hyper or Hypo-parathyroidism, Nephrocalcinosis, Paget's disease, malignancy, tuberculosis, sarcoidosis, and malabsorption syndromes were also excluded from the study. The study was approved by the Ethical review board and written informed consent was taken from each patient. At the enrolment visit, patients were subjected to full clinical history and examination, and pulmonary function testing. Vitamin D [25 hydroxyvitamin D, 25(OH) D] assay was done by Automated Immunoassay Analyzer Model "MINIVIDAS" using Biomerieux reagent in ELFA (Enzyme linked fluorescence assay) Technology. Vitamin D deficiency was defined as 25(OH) D <=20ng/ml, Vitamin D insufficiency was recognized as 21-29 ng/ml and Vitamin D level >30 ng/ml was recognized as sufficient.[15]

The spirometry was performed using Spiro Analyzer ST-150 of the latest Fukuda Sangyo quality, Japan. Post bronchodilator spirometry was performed 15 min after inhalation of 400mcg Salbutamol according to ERS/ATS recommendations. [16] Pre- and post-values were obtained for FVC, FEV1, and FEV1/ FVC. Symptom scoring of patients was done using modified Medical Research Council (mMRC) questionnaires. Associated co-morbidities such as DM, CAD, HTN, CVD, etc. were considered to be present if these patients were previously diagnosed and taking medicines.

Statistical analysis:

Statistical analyses were carried out with the SPSS for Windows software, version 23.0 (SPSS Inc., Chicago, IL, USA). Continuous variables were presented as mean ± standard deviation and categorical variables—as frequency and percentages. Independent sample t-test or F test (ANOVA) was used to determine whether the differences in the means of serum vitamin D levels among different groups were statistically significant. P< 0.05 was considered a statistical significance, and the confidence interval was set at 95%.

Results

Table 1: Baseline characteristics of patients along with vitamin D level

Variables	Frequency	Percent (%)	Mean±SD of vitamin D (ng/ml)	P-value
Age				
61-65 years	25	25	21.30±3.21	0.450
65-70 years	55	55	21.48±.99	
70 years	20	20	24.16±8.26	
Gender				
Male	75	75	22.0±6.08	0.950
Female	25	25	21.93±6.24	
Smoking History				
Never smoke	15	15	21.98±8.13	0.900
Ex-smoker	60	60	22.31±6.08	
Current smoker	25	25	21.39±5.13	
mMRC				
Grade 1	45	45	23.58±6.43	0.270
Grade 2	40	40	21.59±5.55	
Grade 3	10	10	20.8±8.18	
Grade 4	5	5	16.70±2.06	

Type of occupation				
Retired	70	70	22.22±5.92	0.800
Housemaker	10	10	20.12±8.61	
Farmer	5	5	24.26±2.75	
Shopkeeper/Business/Caretaker	15	15	21.44±±6.50	

Among them 75 (75%) were males, and 25 (25%) were females. There was male predominance (75%). The mean age of patients in this study was 72.2±13.8 years, with the majority in 65-70 years. The mean 25(OH) D level was 22.03±6.05 ng/ml (95% CI 8.1-40.2). The mean vitamin D level was higher in males (22.06±6.08 ng/ml) than the females (21.93±6.24ng/ml), but the difference failed to reach statistical significance (P= 0.950). The majority of the participants were former smokers (60%), and the mean pack-year of smoking was 22.09±6.14. In this study, vitamin D levels did not differ between smoking groups. Among non-smokers, it is 21.9±8.1 ng/ml, it is 21.4±5.1 ng/ml in those who are current smokers, and 22.3±6.1 ng/ml among Ex-smokers (P= 0.900). The majority (45%) of patients had mMRC Grade -2 dyspnea, followed by 40% in Grade- 1, 10% in Grade-3, and only 5% of patients had Grade- 4 dyspnea (p=0.270). Regarding vocational status, 70% were retired, 10% was housemakers, farmers 5%, and rest of the 15% was service holders or business people. The mean level of vitamin D was high among farmers (24.26±2.75ng/ml) compared to other occupational groups.

Table 2: Prevalence of vitamin D deficiency and insufficiency in patients with acute exacerbation of COPD

Vitamin D level	Frequency	Percent (%)
Normal	15	15
Insufficient	50	50
Deficient	35	35

In the study, only 15% of the patients had sufficient levels of serum vitamin D. The majority had an insufficient level of serum vitamin D (50%), and 35% had a deficient level of serum vitamin D.

Discussion

The study determined the effect of vitamin D supplementation in reducing number of acute exacerbation in" COPD" patients. Vitamin D deficiency is prevalent amongst patients with chronic obstructive pulmonary disease (COPD) and comes to be more frequent with increased disease severity. Chronic obstructive pulmonary disease (COPD) is a common preventable and treatable disease, characterized by persistent air flow limitation that is usually progressive and associated with an enhanced chronic inflammatory response of airways and the lungs to noxious particles or gases; exacerbation and comorbidities contribute to the overall severity in individual patients. [17]

According to the available studies, the prevalence of hypovitaminosis D in COPD patients varies between 31– 77%. [11] This study found the highest prevalence (85%) in hypovitaminosis D compared to previous studies. The prevalence and severity of hypovitaminosis D in our study were significantly higher when compared to unselected Bulgarian population. [18] In this study most of the affected patients are male, this is because males are more commonly smokers than females in our country. Among those females who were admitted with AECOPD, many of them were not a smoker but were still affected which can be explained by exposure to passive smoking and the use of biomass fuel while cooking.

We found most of the patients were from the rural area and either primarily educated or illiterate reflecting poor access of the rural people to health services and lack of knowledge regarding a healthy diet containing vitamin D or proper exposure to sunlight which is the main source of vitamin D in our area In this study, we found vitamin D deficiency is a little bit more common among females which correlates with a previous study where vitamin D deficiency and insufficiency were significantly more prevalent among females (97.7% vs 77.8%; p = 0.003). [14] In the present study, vitamin D level among farmers was (24.26±2.75) but this is not significant because only three patients belonged to this occupation. So it needs to include a large number of patients from these professionals to show any significant difference.

There is evidence that smoking is a risk factor for vitamin D deficiency [19], but our study did not find significant differences in the prevalence of hypovitaminosis D related to smoking status (p = 0.900) which is similar to the previous study. [18] Our study showed differences in mean vitamin D levels in patients with fewer symptoms (mMRC- 1) compared to patients with more symptoms (mMRC- 4) (mean 23.58 vs 16.7 ng/ml) which is similar to the results from other studies about the positive correlation between low vitamin D concentration and reduced quality of life. [20]

For COPD, the vitamin D pathway is an attractive target for intervention studies because vitamin D deficiency may enhance chronic airway and systemic inflammation, reduce bacterial clearance, and increase the risk for infectious exacerbations at the same time. [21] Deficiency in 25-hydroxyvitamin D results from a number of causes and is associated with increased risk of infections including influenza, TB and pneumonia. [22] On contrary Rezk et al. [23] in their study found a significant improvement in dyspnea scale ($p < 0.003$), coupled with a decrease in disease exacerbations ($p < 0.001$) and CRP ($p < 0.001$) a year after vitamin D replacement. [24]

Conclusion

This study finds a high frequency of hypovitaminosis D (85%) in AECOPD patients. Vitamin D deficiency and insufficiency are more prevalent in females. In this study, vitamin D levels did not differ between smoking groups. Preventing exacerbations is a major treatment goal of COPD and the benefit of vitamin D supplementation may be an intervention that warrants further assessment. However randomized controlled trials are needed to clarify whether the observed association in the present study is causal and is attributable to vitamin D deficiency.

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