

Correlation of vitamin D deficiency with frequent exacerbations in COPD patients at tertiary care hospital in western Rajasthan

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Abstract

Background: Acute exacerbations is common in COPD patients and has a direct correlation with the disease severity and rising expenditure incurred on healthcare of such patients. Amongst other deficiencies in COPD Patients, deficiency of Vitamin D has always remained a topic of debate amongst the clinicians as to its role in disease exacerbations. The present study is yet another attempt to find any relation between deficiency of Vitamin D and acute exacerbation in COPD, if any. **Aim of study:** To assess the relationship of serum vitamin D levels with COPD severity and exacerbation. **Methods:** Study was conducted between September 2018 to September 2019 in which 102 patients with complaint of COPD were taken within the purview of this study and their Serum 25-hydroxyvitamin D (25-OHD) level, results of spirometry, history and records of their acute exacerbation of COPD and hospital admissions were recorded and analyzed. **Results:** Amongst the patients analyzed, their vitamin D status was categorized as vitamin D deficiency, vitamin D insufficiency and vitamin D sufficiency for better understanding of the results and they were found to be 15.7%, 22.5% and 61.8% respectively. A significant inverse relationship was found between deficiency of vitamin D and acute exacerbation of COPD. **Conclusions:** Since it was found that there is a significant inverse relation between deficiency of vitamin D and acute exacerbation of COPD, therefore it is suggested that COPD patients may be supplemented with Vitamin D so as to bring down the episodes of acute exacerbation in COPD patients.

Keywords: Vitamin D, COPD, Acute exacerbation

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Introduction

Chronic Obstructive Pulmonary Disease commonly known as COPD is defined as a systemic inflammatory disease where airflow limitation is not fully reversible[1]. Average prevalence of COPD is 6.2% in Asia[2]. Amongst various respiratory disease, COPD is believed to be a major cause of chronic morbidity and mortality[3] and is one of the leading cause of death occurring due to respiratory failures. The World Health Organization had already predicted that COPD will become the third leading cause of death worldwide by 2020[3,4].

The rate of recurrence of COPD also has a heavy influence on healthcare costs involved in its treatment and management[5], as frequent disease exacerbations are bound to reflect in sharp rise in hospital admissions for its treatment. Although COPD is a chronic obstructive disease but still if proper dietary intake and exercise is regularly included in life style then the effects of the the same can be postponed, however, in the circumstances of our country it is far from being under control due to lack of dietary consciousness[6].

Apart from that, Vitamin D deficiency itself is yet another matter of concern amongst the COPD patients due to lower intake of Vitamin D, inactivity, reduced capacity of synthesis of Vitamin D in aged patients due to ageing skin, absence of sun exposure and increased

catabolism by glucocorticoids[8].

Pathogenesis of COPD is effected by level of Vitamin D in several ways, such as in reducing the frequency of respiratory infections, impairing response to pathogens and inhibiting the proliferation of airway smooth muscle[7].

Materials and Methods

Study population

This cross-sectional study was performed in 102 patients with the complaint of COPD. The study was carried from September 2018 to September 2019 at a Tertiary Care Centre in Rajasthan. Study was conducted after taking necessary ethical clearance from the institutional ethical committee and informed consent was obtained from all participants.

Only patients with confirmed diagnosis of COPD were included in the study.

Exclusion criteria

- Patients suffering from tuberculosis, pleural effusion, congestive heart failure, primary pulmonary hypertension, pulmonary emboli, restrictive airway disease;
- disease that are in any way associated with vitamin D metabolism and absorption;
- patients on vitamin D medication, and
- patients not giving consent for the study.

Sample Size

For the present study, sample size was calculated by convenience sample method.

Study Design

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The participants of the study were primarily clinically examined and then they were tested for serum vitamin D levels and spirometry was done to assess their lung function.

For ascertaining the medical history of the participants, their past medical records and treatment history were collected and reviewed to record the acute exacerbation of COPD by determining unscheduled visits due to acute worsening of respiratory symptoms, change or increase in medications, use of antibiotics or oral steroids and/or requiring hospitalization [9,10] in the last year.

The severity of COPD was defined according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) criteria [11].

For the purpose of categorizing the vitamin D level in the participants, Endocrine Society Clinical Practice Guidelines [12-14] were used and according to it 25-hydroxyvitamin D level less than 20 ng per milliliter is indicative of deficiency, 21-29 ng per milliliter indicative of insufficiency and 30 ng per milliliter or greater is indicative of sufficiency in vitamin D level.

Statistical analyses

Statistical analyses were performed using the software SPSS Inc v.13, Chicago, IL, USA. Significant differences between patients were tested using the Chi-square test or Fisher’s exact test and *p* value <0.05 is considered statistically significant.

Results

The mean age of participants was 63.28 years (SD 10.725 years) with a male to female ratio of 6.2:1. 85.3% of the participants had smoking history.

On the basis of the results obtained from spirometry test, patients were classified into mild, moderate, severe and very severe COPD patients according to the GOLD criteria and patients in each of the category were 30.4%, 33.3%, 28.4% and 7.8% respectively. The level of vitamin D among the patients were categorized as vitamin D deficient, vitamin D insufficient and vitamin D sufficient and were found to be 15.7%, 22.5% and 61.8% respectively among COPD patients.

Patients with Vitamin D deficiency and insufficiency showed a positive co-relation with severity of COPD and the co-relation was statistically significant. It was also found that Vitamin D deficiency and insufficiency was significantly high in patients with severe and very severe disease when it was compared with patients having mild to moderate disease; *p* <0.0001.

Of the 102 patients, 60 of them (59.8%) were found to have exacerbations in previous year. Their vitamin D levels analysis were when classified by number of exacerbations in the year preceding the study, it showed that the higher the number of acute exacerbations of COPD lower were the vitamin D levels (*p* < 0.0001)

Table: Anova repeated measured for Vitamin D levels in study

Type of Parameters	≥31 (n=63)	20-30 (n=23)	<20 (n=16)	Chi test	d.f.	P value
Gender						
Male	56	20	12	2.090	2	0.351
Female	07	03	04			
Age						
< 40 years	02	00	00	6.392	08	0.603
41-50	11	06	01			
51-60	25	07	06			
61-70	11	06	06			
> 71	14	04	03			
Exacerbation						
0	38	02	02	30.259	6	<0.0001
1	08	08	05			
2	08	05	07			
≥3	09	08	02			
Hospital ad.						
No	49	09	06	11.536	2	0.003
Yes	14	14	10			
Gold Stage						
I	30	01	00	34.965	6	<0.0001
II	16	11	07			
III	15	10	04			
IV	02	01	05			
COPD groups						
A	29	02	00	31.457	6	<0.0001
B	16	06	02			
C	15	12	08			
D	03	03	06			

Discussion

The irresistible inference which can be gathered from the data accumulated is that the COPD patients have vitamin D deficiency. The level of vitamin D amongst the patients, vitamin D deficiency, vitamin D insufficiency and vitamin D sufficiency was found 15.7%, 22.5% and 61.8% respectively.

Severe deficiency of Vitamin D was found to be directly associated with frequent exacerbations and hospitalization during the previous year among most of the patients.

Impaired vitamin D level in COPD patients can be attributed to the causes such as reduced outdoor activities, lower storage capacity in

muscle and fat due to wasting, impaired activation of Vitamin D as a consequence of renal dysfunction, reduced capacity of aging skin for synthesis of vitamin D, lower food intake containing Vitamin D and increased glucocorticoids-induced catabolism [15].

Franco et al [16]. found that patients with COPD, even without the chronic use of systemic glucocorticoids, have increased risk for low levels of vitamin D, which is correlated with the severity of disease. Results of this study reiterates similar finding where rising deficiency has indicated acute exacerbation in COPD patients.

Vitamin D level was when compared with other clinical variables, it was found that that serum 25-OHD showed significant direct co-

relation with pulmonary function test parameters (FEV₁) among COPD patients. Similar finding was also given in the study conducted by Janssens et al[17].

In contrast to the results of this study and results cited of above studies, another study reported by Shaheen et al[18], in an older adult UK population (the Hertfordshire Cohort study) did not show a positive correlation between serum 25(OH)D concentrations and lung function in spirometrically defined COPD patients. This study concluded that vitamin D is not an important determinant of adult lung function in COPD. Difference in the result may be due to the difference in the age group and geographical positioning of the participants because the mean age of the participants in the study conducted by Shaheen et al was 49 years living in UK whereas the mean age of the participants in this study is 63.28 years and they belong to Western Rajasthan, India.

It cannot be stated with complete certainty that how vitamin D levels might affect lung function, however, potential explanations to it can be due to the calcemic effects of vitamin D. This is because the vital capacity and total lung capacity were found to decline with an increasing number of thoracic vertebral fractures as a direct consequence of vitamin D deficiency[19]. Kyphosis related to osteoporosis caused limitation in rib mobility and inspiratory muscle function and correlated with a reduction in FEV₁ and FVC[20].

Statistics of the present study has revealed that vitamin D level in the patients had an inverse relationship with the severity of COPD disease. An analysis of vitamin D levels stratified by number of exacerbations in the year preceding the study entry showed that the higher the number of acute exacerbations of COPD associated with the lower the vitamin D level. ($p < 0.0001$) Similar results were found in the study conducted by Heulens et al[21].

Conclusion

It was found that vitamin D deficiency is prevalent among patients with COPD and the frequency of acute exacerbation increases with rising vitamin D deficiency. Therefore, it can safely inferred from the data accumulated that vitamin D supplementation can be an essential component for prevention of exacerbations. However, since the present study was conducted on a small group of participants and that too from a specific geographical location, global randomized controlled trials are required for further clarification on the subject that whether there is a correlation between vitamin d deficiency and frequency of acute exacerbation of COPD.

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