ASSOCIATION OF VITAMIN D LEVEL AND FORCED EXPIRATORY VOLUME IN FIRST SECOND IN COPD PATIENTS

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Abstract

Background: Chronic Obstructive Pulmonary Disease (COPD) is a major cause of morbidity and mortality throughout the world which is preventable as well as treatable disease. In recent years, multiple roles of vitamin D have been highlighted in various diseases. Data on vitamin D status in COPD in Bangladeshi population are still limited. Aim of our study is to see any association between vitamin D level and FEVI (Forced Expiratory Volume in First Second) in COPD patients.

Materials and methods: Fifty cases of COPD patients were diagnosed by GOLD (Global Initiative for Chronic Obstructive Lung Disease) criteria included in this study conducted at Medicine Department of Chittagong Medical College Hospital for six months period from April 2018 to September 2018. Serum vitamin D 25-OH level were assessed by enhance chemiluminance method and post-bronchodilator FEV1 was measured in all patients by spirometry.

Results: The mean age of patients was 64.50 ± 7.60 years. The mean serum 25-OHD level was 21.69 ± 7.39 ng/ml and mean FEV1 (%) was 20.62 ± 18.80. There was very strong positive correlation present between, serum 25-OHD and FEV1% of predicted. Only 16% of the COPD patients had sufficient vitamin D level, 42% had insufficient and other 42% had deficient vitamin D status.

Conclusion: COPD patients with more severe disease tend to have lower serum Vitamin D level.

Key words
COPD; FEV1; 25-OHD; GOLD.

Introduction

Chronic Obstructive Pulmonary Disease (COPD) is defined by the American Thoracic Society (ATS) as a progressive and partially reversible disease of respiratory tract featured by the limitation of airflow that takes place as a result of chronic bronchitis or emphysema. COPD is a global public health burden of the 21st century[1]. In 2005, worldwide, 5% deaths were due to COPD [2]. If this situation continues, COPD will be the third leading cause of global death by 2030[3]. Strikingly, almost all (90%) of the deaths caused by COPD occurred in Low and Middle-Income Countries (LMICs)[4]. Bangladesh, like other LMICs, is facing epidemiological change with an increasing burden of Non-Communicable Diseases (NCDs) like COPD [5,6]. A recent systematic review revealed that the overall prevalence of COPD among Bangladeshi adults was 12.5% using the GOLD criteria[7]. This finding is consistent with the finding of a recent systematic review on the global and regional prevalence of COPD where it was reported that globally 11.7% individuals are currently suffering from COPD but the prevalence is higher in comparison to that in South East Asia (9.7%)[5]. Vitamin D is conventionallyknown for its role in bone health and homeostasis of calcium and phosphate[8]. Besides this, vitamin D is related to cell proliferation, cell differentiation, apoptosis, and intercellular adhesion[9]. Patients with advanced COPD frequently have vitamin D deficiency. Factors that explain this include the cutaneous synthesis of vitamin D due to age and toxic effects of tobacco, less exposure to sunlight, increased catabolism of glucocorticoids, its sequestration in adepocytes, reduced intestinal absorption and poor hepatic and renal activation of vitamin D precursor.

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Airway remodeling is the most characteristic hallmark of COPD can be affected by vitamin D deficiency[10]. Epidemiological studies in healthy subjects have noticed a strong relationship between 25-hydroxyvitamin D and pulmonary function, as assessed by FEV1. Keeping this in view, the study was conducted to see the relationship between vitamin D and FEV1 in COPD patients.

Materials and methods

This descriptive cross-sectional study was done at Department of Medicine, Chittagong Medical College Hospital from 01/04/2018 to 31/09/2018 after written informed consent from the patient.

Inclusion criteria

i. Age≥40 years (In patient)

ii. Patients with history suggestive of COPD and spirometryconfirmed COPD as per GOLD criteria (post bronchodilator FEV1/FVC ratio of < 70%).

Exclusion criteria

i. Unwilling to give written informed consent

ii. Patients with H/O tuberculosis, pleural effusion, congestive heart failure, primary pulmonary hypertension, pulmonary emboli, restrictive airway disease, chronic liver disease, chronic kidney disease, sarcoidosis and conditions associated with vitamin D metabolism, absorption

iii. Patients taking vitamin D supplementation (20000 IU for 3 months).

50 COPD patients were recruited in the study. After informed consents pirometry was performed in each patient by Minispir II S/N CO6754. Four ml of blood was sent tolaboratory for Hb%, TC, ESR & 25-hydroxy vitamin D (25-OHD) estimation by chemiluminescence immuneassay(CLIA) machine.Vitamin D deficiency was defined as 25(OH)D <20ng/mL,Insufficiency (<30ng/mL), sufficiency (>30ng/mL)[11]. The data were gathered using the patients' evaluation forms. All the data were checked and edited after collection. The statistical analysis was carried out by using Statistical Package for Social Sciences (SPSS -23). Continuous variables were described as mean ± SD and compared between groups by Independent sample t-test or F test (One Way Analysis of Variance). Qualitative or categorical variables were described as frequencies and proportions and compared with Chi-square test or Fisher's Exact test whichever was applicable. Correlation between two continuous variables was tested by Pearson correlation coefficient. p value<0.05 was taken as significant.

Results

Mean age of the study population was 64.50 (± 7.60) years.

Table I: Demographic characteristics of the 50 COPD patients (%).

Demographic variables	Frequency	Percent (%)
Age (Years)		
49-59	15	30.0
60-69	20	40.0
70-80	15	30.0
Mean ± SD	64.50 ± 7.60 (49-80)	
Sex		
Male	25	50.0
Female	25	50.0
Locality		
Urban	12	24.0
Rural	38	76.0

Table II : Spirometry and laboratory parameters of the studied patients.

Parameters	Mean ± SD	Min-Max
Hb (gm/dl)	11.74 ± 1.79	9.00-16.00
TC	10887.40 ± 2381.82	6500.00-15350.00
ESR	43.26 ± 8.85	28.00-60.00
FEV1 (%)	20.62 ± 18.80	11.00-86.00
Vitamin D level, ng/ml	21.69 ± 7.39	6.53-37.34

Mean (±SD) of vitamin D level was 21.69 (±7.39) ng/dl and mean (±SD) of FEV1 was 20.62 (± 18.80) % predicted.

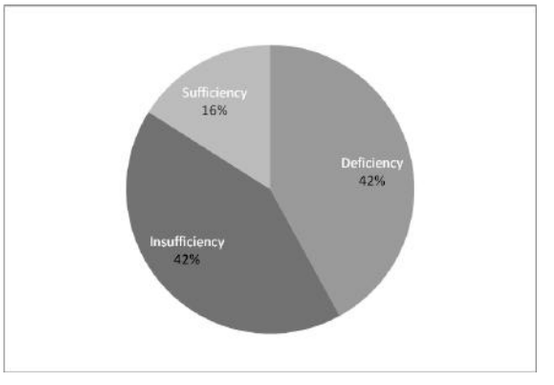

Fig 1: Distribution of the patients according to Vitamin D status.

Majority of the COPD patients were either vitamin D inefficient (42%) or vitamin D defficient (42%). Only 16% of the patients had sufficient vitamin D (Figure 1).

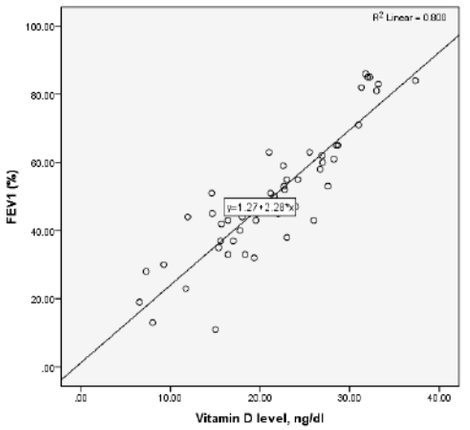

Fig 2 : Correlation between vitamin-D level with FEV1.

There was a strong positive correlation between vitamin D level and FEV1 (Pearson correlation coefficient r= 0.895, p value <0.001).

Table III : Comparison of mean value of vitamin-D level in relation to different patient's characteristics.

Characteristics		Frequency	Mean ± SD of vitamin D, ng/ml	p value
	49-59 years	15	21.31±5.01	
Age group	60-69 years	20	22.27±6.89	0.524†
	70-80 years	15	21.27±6.83	
Sex	Male	25	21.24±7.49	0.670‡
	Female	25	22.14±7.41	
Locality	Rural	38	21.40±7.47	0.635‡
	Urban	12	22.58±7.37	
Smoking status	Current	23	21.32±7.48	
	Ex	12	20.93±8.37	0.850†
	Never	8	23.79±5.73	
	Passive	7	21.77±6.78	
	<18.5 kg/m^2	4	22.89±6.94	
BMI	18.5-22.9 kg/m^2	24	21.45±7.21	0.845†
	23-24.9 kg/m^2	7	22.21±6.22	
	≥25.0 kg/m^2	5	19.78±10.42	

†ANOVA test was done to measure the level of significance. ‡: Independent sample t test was done .The mean vitamin-D levels were not statistically significantly different in relation to age, gender, BMI, smoking status and residence (Table III).

Discussions

In this observational cross sectional study, a direct linear relationship was found between serum 25-OHD levels and FEV1 values in the patients, which was statistically significant. Similar relationship was found between serum 25-OHD level and FEV1 value in a study conducted on 414 smoking patients aged over 50 by Janssensetal[12]. In the current study, prevalence of vitamin-D deficiency was 42%, lower than observation made by Jung JY et al but higher than a study performed by Said[13,14]. In the present study, the mean serum vitaminD level was 21.69 ± 7.39 ng/ml. Zhu et al. conducted a metaanalysis which confirmed that COPD patients had low serum vitaminD levels than control subjects[15]. Although we did not observed statistically significant difference of vitamin-D levels in relation to BMI (p=0.845) similar to Gupta et al[16]. Though, we found lower levels of vitamin-D in obese (BMI ≥ 25.0 kg/m^2) as compared to normal BMI patients, similarly observed by Persson et al.[17]. In this study, a significant association was found between age and FEV1 and as the age increased FEV1 decreased. Similarly Azargoon et al reported asignificant inverse linear relationship[18].

Limitation

i. Sample size was small so the results cannot be generalized to overall population
ii. Shorter duration of follow up
iii. Single center study.

Conclusion

The study showed that there is a significant linear relationship between serum 25-hydroxy vitamin D level and values of FEV1 in patients with chronic obstructive pulmonary disease. Moreover, present study results showed that vitamin D deficiency is common in COPD patients and majority of the COPD patients (84%) either had insufficient or deficient vitamin D level. Serum vitamin D decreases along with severity of COPD increases.

Recommendation

It is important to look for Vitamin D deficiency for a comprehensive management, a better patient outcome and enhanced quality of life in patients of COPD.

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Contribution of authors

MRM-Conception, acquisition of data, drafting and final approval.

MHH- Data analysis, interpretation of data and final approval.

MNK- Acquisition of data, drafting and final approval.

EEU- Design, interpretation of data, critical revision and final approval.

AB-Interpretation of data, critical revision and final approval.

TTC-Analysis,drafting and final approval.

KMAH - Acquisition of data, drafting & final approval.

Disclosure

All the authors declared no competing interests.

References

1. American Thoracic Society. Standard for the diagnosis and care of patients with chronic obstructive pulmonary disease. Am J RespirCrit Care Med. 1995;152:77–121.

2. Chronic Obstructive Pulmonary Disease (COPD). [Internet] Available from: http://www.who.int/mediacentre/factsheets/fs315/en/ 2017.

3. McKay AJ, Mahesh PA, Fordham JZ, Majeed A. Prevalence of COPD in India: A systematic review. Prim Care Respir J. 2012;21(3):313–321.

4. Adeloye D, Chua S, Lee C et al. Global and regional estimates of COPD prevalence: Systematic review and meta-analysis. J Glob Health. 2015; 5(2):020415. doi:10.7189/jogh.05-020415

5. Ahsan KZ, Alam N, Kim SP. Epidemiological transition in rural Bangladesh. 1986-2006. Glob Health Action. 2009;2:10.3402/gha.v2i0.1904. Published 2009 Jun 19. doi:10.3402/gha. v2i0.1904.

6. Biswas T, Islam MS, Linton N, Rawal LB. Socio-Economic Inequality of Chronic Non-Communicable Diseases in Bangladesh. PLoS One. 2016;11(11):e0167140. Published 2016 Nov 30. doi:10.1371/journal.pone.0167140.

7. Sutradhar I, Das Gupta R, Hasan M, Wazib A, Sarker M. Prevalence and Risk Factors of Chronic Obstructive Pulmonary Disease in Bangladesh: A Systematic Review. Cureus. 2019;11(1):e3970. Published 2019 Jan 28. doi:10.7759/cureus.3970.

8. Reid IR, Bolland MJ, Grey A. Effects of vitamin D supplements on bone mineral density: A systematic review and meta-analysis. Lancet. 2014; 383(9912):146–155.

9. Samuel S, Sitrin MD. Vitamin D's role in cell proliferation and differentiation. Nutr Rev. 2008;66(10 suppl 2):S116–S124.

10. Holick MF. Vitamin D deficiency. N Engl J Med. 2007;357:266–281.

11. Pal N, Mazumder MS, Akter S et al. Soco-economis status of the Ethnic Community in Bngladesh : An Analysis Using Socio Economic index. IOSR Journal of Economics and Finance. 2017:8(3): 92-97.

12. Janssens W, Lehouck A, Carremans C, Bouillon R, Mathieu C, Decramer M. Vitamin D beyond bones in chronic obstructive pulmonary disease: time to act. Am J RespirCrit Care Med. 2009;179(8):630–636.

13. Jung JY, Kim YS, Kim SK, Kim HY, Oh YM, Lee SM, Seo JB, et al. Relationship of vitamin D status with lung function and exercise capacity in COPD. Respirology. 2015; 20:782–789.

14. Said AF. Vitamin D and chronic obstructive pulmonary disease. Egyptian Journal of Chest Diseases and Tuberculosis.2015; 64(1):67–73.

15. Zhu M, Wang T,Wang C, Ji Y. The association between vitamin D and COPD risk, severity and exacerbation: An updated systemic review and meta analysis. International Journal of COPD. 2016;11:2597-2607.

16. Gupta BK, Meena SL, Saini M, Nehara HR, Saini ML, Gupta J. Evaluation of Vitamin-D Level in Patients of Chronic Obstructive Pulmonary Disease (COPD) and Its Clinical Correlation. Indian Journal of Medical & Health Sciences. 2016;3(2):108-110.

17. Persson LJ, Aanerud M, Hiemstra PS, Hardie JA, Bakke PS, Eagan TM. Chronic obstructive pulmonary disease is associated with low levels of vitamin D. PLoS One. 2012;7(6):e38934. doi:10.1371/journal.pone.0038934.

18. Azargoon AR, Moghadam PK, Shokrollahi S, Ebrahimzadeh F, Pournia Y. Relationship Between FEV1 and 25-hydroxy Vitamin D in Patients with Chronic Obstructive Pulmonary Disease. Trends in Medical Research. 2011; 6 (3): 184-190.