Section: Medicine

Original Research Article

ASSOCIATION OF VITAMIN D LEVELS WITH THE SEVERITY OF BRONCHIAL ASTHMA

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Abstract

Background: The rising prevalence of bronchial asthma in developing nations like India is attributed to various factors like urbanization, environmental pollution, industrialization, lifestyle changes. To find out association of Vitamin D levels with severity of Bronchial Asthma. **Materials and Methods:** This observational and cross-sectional study was conducted in Department of Medicine, L.L.R.M Medical College, Meerut. 90 patients from Medicine and TBCD OPD/IPD were selected randomly. **Result:** Minimum age was 16 years and maximum was 59 years. Most of the patients were in age group 16-30 years. Majority of the patients were Vitamin D deficient (40.0%). Majority of the patients had FEV1 levels >80% (48.9%). Majority of the study population belonged to Moderate Severity of Asthma (33.3%) whereas 28.9% had Intermittent Severity of Asthma. The Vitamin D deficiency levels correlated positively with severity of Bronchial Asthma and correlation was highly significant ($p<0.001$). **Conclusion:** Supplementing Vitamin D in asthmatic patients has been shown to be beneficial. However, the temporality of this observation still needs to be established.

INTRODUCTION

Bronchial asthma is one of the most common diseases affecting nearly 300 million people globally (i.e.,) 8-10 % of the population. The rising prevalence of bronchial asthma in developing nations like India is attributed to various factors like urbanization, environmental pollution, industrialization, lifestyle changes.[1]

Bronchial asthma is a chronic inflammatory disease of the airways characterized by airway hyper responsiveness and airflow obstruction that is often reversible at least in the initial stages.[2] The pathogenesis of asthma is very complex and is not fully elucidated yet. A variety of cells and inflammatory mediators play a critical role in initiating, perpetuating and coordinating the repeated cycles of inflammation. The fundamental pathology in asthma is the exaggerated TH2 response to normally harmless environmental antigens resulting the release of TH2 cytokines mainly interleukins 4,5 and 13 of which IL4 and IL 13 are responsible for the production of antigen specific IgE by B lymphocytes. IL 5 is responsible for prolonging the survival of eosinophils.[2,3]

Vitamin D is found to have anti-inflammatory activity in several in vitro studies. Vitamin D reduces inflammation by decreasing the levels of proinflammatory cytokines and increasing he levels of anti-inflammatory cytokines like interleukin 10.4) Vitamin D also reduces bronchial smooth muscle cell hypertrophy and hyperplasia. In addition, vitamin D improves response to inhaled and oral corticosteroids.5 Thus, Vitamin D by inhibiting the cycles of chronic inflammation reduces airway remodelling which is the major pathologic change seen in the lungs of asthmatic patients.6 Based on the anti-inflammatory and immunomodulatory effects of cholecalciferol, this study was taken up to evaluate the correlation of severity of Asthma with Vitamin D levels.

Aims and Objectives

Aim: To find out association of Vitamin D levels with severity of Bronchial Asthma.

Objectives

1. To evaluate Vitamin D levels in Bronchial Asthma.
2. To evaluate correlation of Vitamin D levels with severity of Bronchial Asthma.

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MATERIALS AND METHODS

This observational and cross-sectional study was conducted in Department of Medicine, L.L.R.M medical college, Meerut. 90 patients from Medicine and TBCD OPD/IPD were selected randomly.
Informed consent was taken from all the patients. These patients were subjected to complete history taking and physical examination. Particulars of the patients such as name, age, sex, degree of airway obstruction etc. Were noted in a Proforma. The patients of study group were examined and various required investigations were done.

Inclusion Criteria

- Both genders.
- Age- 15 – 70 yrs.
- Patients with bronchial asthma.
- Patients willing to give written informed consent.

Exclusion Criteria

- Pregnant and lactating women.
- Patients with evidence of clinically significant gastrointestinal, renal, respiratory, haematological, endocrinological, neurological, psychiatric or cardiovascular dysfunctions.
- Current smokers
- Patients already on vitamin D, calcium supplementations
- History of intolerance to cholecalciferol.
- Patients taking drugs like beta blockers, non-steroidal anti-inflammatory drugs etc which are known to exacerbate bronchial asthma.
- Patient enrolled in any other study.

Sample Size Calculation

Based on the annual report 2021-22 of Ministry of Health and Family Welfare taking prevalence of Bronchial Asthma as 6.5% with 5% absolute precision and 95% confidence interval, the following formula was used to calculate minimum sample size.

N=(1.96)2 pq
$d2$

Wherep=Prevalence
N=sample size
D=absolute precision
Q=1–p

Thus by above formula sample size calculated as 90
Study Tool: Severity of Asthma was classified according to Global Initiative for Asthma (GINA) guidelines on the basis of history, PFT and Asthma Severity Questionnaire.

Statistical Analysis

Data was collected and entered in MS Excel and analyzed in IBM SPSS (Statistical Package for Social Sciences) software 21.0. Categorical data is summarized in terms of frequency and their percentage whereas quantitative data is summarized thorough mean + SD. Normality of the data is also checked by Kolmogorov-Smirnov test and then analyzed by using appropriate statistical test $p<0.05$ is considered as significant.

RESULTS

Minimum age was 16 years and maximum was 59 years. Most of the patients were in age group 16-30 years (45.6%).[Table 1]

Components of Severity	Intermittent	Mild	Moderate	Severe
Symptoms	≤2days/week	>2days/weekbutnotdaily	Daily	Throughouttheday
Night time awakenings	≤2x/month	3-4x/month	> 1 x/weekbutnot nightly	Often7x/week
Short-acting β2-agonist use for symptom control	≤2days/week	>2days/weekbutnotdaily,andDailynotmore than 1xonanyday	Daily	Severaltimesperday
Interference with normal activity	None	Minorlimitation	Some limitation	Extremely limited
Lung function	NormalFEV1between exacerbations FEV1 >80% predicted FEV1/FVCnormal	FEV1>80% FEV1/FVC normal	FEV1 >60% but predicted <80% predicted FEV1/FVCreduced 5%	FEV1 <60% predicted FEV1/FVCreduced>5%
Recommended Step for Initiating Treatment	Step1	Step2	Step3andconsider shortcourse oforalsystemiccorticosteroids	Step4or5andconsidershortcourseoforalsystemiccorticosteroids

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Table 1: Age distribution of patients (n=90)

Age group	No. of cases	Percentage
< 30	41	45.6%
31-40	21	23.3%
41-50	19	21.1%
> 50	9	10.0%
Total	90	100.0%

Sex wise distribution of the patients can be observed from [Table 2]. Majority of the patients were males (52.2%) as compared to Females (47.8%). [Table 2]

Table 2: Sex distribution of patients(n=90)

Sex	No. of cases	Percentage
Female	43	47.8%
Male	47	52.2%
Total	90	100.0%

Majority of the patients were Vitamin D deficient (40.0%), as compared to 36.7% who had insufficient Vitamin D levels and 23.3% who had sufficient Vitamin D levels. [Table 3]

Table 3: Vitamin D levels in the study population

Vitamin D (ng/mL)	No. of cases	Percentage
< 20 (Deficient)	36	40.0%
20-30 (Insufficient)	33	36.7%
> 30 (Sufficient)	21	23.3%
Total	90	100.0%

Majority of the patients had FEV1 levels >80% (48.9%) as compared to 6.7% who had FEV1 between 60%-69%, 32.2% who had FEV1 between 70%-79% and 12.2% who had FEV1 between 35%-49%.

Table 4:FEV1 levels in the Study Population

FEV1	No. of cases	Percentage
35%-49%	11	12.2%
60%-69%	6	6.7%
70%-79%	29	32.2%
> 80%	44	48.9%
Total	90	100.0%

Majority of the study population belonged to Moderate Severity of Asthma (33.3%) whereas 28.9% had Intermittent Severity of Asthma, 25.6% had mild Asthma and 12.2% had Severe Asthma. [Table 5]

Table 5: Severity of Asthma in the Study Population

Severity of Asthma	No. of cases	Percentage
Intermittent	26	28.9%
Mild	23	25.6%
Moderate	30	33.3%
Severe	11	12.2%
Total	90	100.0%

Anthropometric Parameters

Table 6: Descriptive measures of the study population (n=90)

	N	Minimum	Maximum	Mean	Std. Deviation
Age	90	16.00	59.00	33.86	11.25
Vitamin D level	90	8.00	41.00	23.62	7.43
Lung Function FEV1	90	40.00	94.00	75.33	14.31
Eosinophil Count	90	400.00	650.00	526.81	70.54

Table 7: Vitamin D levels and Severity of Bronchial Asthma

		Intermittent		Mild		Moderate		Severe		Total	p-value
		No. of cases	%	No. of cases	%	No. of cases	%	No. of cases	%		
Vit D (ng/mL)	< 20	2	7.7%	4	17.4%	22	73.3%	8	72.7%	36	0.001
	20-30	10	38.5%	15	65.2%	6	20.0%	2	18.2%	33	
	> 30	14	53.8%	4	17.4%	2	6.7%	1	9.1%	21	
Total		26	100.0%	23	100.0%	30	100.0%	11	100.0%	90	

The Vitamin D deficiency levels correlated positively with severity of Bronchial Asthma and correlation was highly significant ($p<0.001$).

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In patients with Intermittent Bronchial Asthma, 53.8% patients had sufficient (>30 ng/mL) Vitamin D levels as compared to 38.5% patients who had insufficient (20-30 ng/mL) Vitamin D levels and 7.7% patients who had deficient (<20 ng/mL) Vitamin D levels.

In cases with Mild Bronchial Asthma, 65.2% patients had insufficient (20-30 ng/mL) Vitamin D levels as compared to 17.4%patients who had sufficient (>30 ng/mL) Vitamin D levels and 17.4% patients who had deficient (<20 ng/mL) Vitamin D levels.

In cases with Moderate Bronchial Asthma, 73.3% patients had deficient (<20 ng/mL) Vitamin D levels as compared to 20%patients who had insufficient (20-30 ng/mL) Vitamin D levels and 6.7% patients who had sufficient (>30 ng/mL) Vitamin D levels.

In cases with Severe Bronchial Asthma, 72.7% patients had deficient (<20 ng/mL) Vitamin D levels as compared to 18.2%patients who had insufficient (20-30 ng/mL) Vitamin D levels and 9.1% patients who had sufficient (>30 ng/mL) Vitamin D levels.

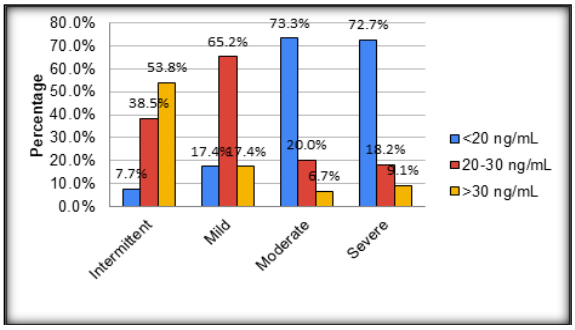

Figure 1: Correlation of Vitamin D levels with Severity of Bronchial Asthma

DISCUSSION

The present study was conducted to know the association of vitamin D deficiency with bronchial asthma. We observed that the serum vitamin D levels were significantly lower in patients with moderate and severe bronchial asthma. Also only 9.1 % and 6.7 % patients with severe and moderate bronchial asthma respectively had sufficient vitamin D levels. The literature reports varied results about the association of vitamin D and development of bronchial asthma. The prevalence of vitamin D deficiency in Italian asthmatic children was found to be 53%.[7]

Recently conducted clinical trials have shown protective influence of vitamin D supplementation among asthmatic patients.[8] Moreover, increased intake of vitamin D during pregnancy has been shown to have an influence on asthma in children and adults. Gale et al demonstrated that children whose mothers had serum 25(OH)D concentrations above 75 nmol/L had five times more risk of developing asthma at 9 years.[9] Studies from Finland and Japan found that dietary vitamin D intake during pregnancy is inversely related to the incidence of wheeze among children.[10] In contrast, another study concluded that vitamin D levels during late pregnancy were not related with the risk of childhood asthma.[11] In addition to its role in the development of asthma, Vitamin D also has a role in asthma exacerbation. Furthermore, Brehm et al confirmed that children with vitamin D less than 30 ng/mL had increased risk of asthma exacerbations.[12]

CONCLUSION

Supplementing Vitamin D in asthmatic patients has been shown to be beneficial. However, the temporality of this observation still needs to be established. For this, clinical trials with large sample size and long follow up period are required. The appropriate dose, route, and safety of vitamin D supplementation in asthmatics needs to be established as well. Although the current evidence does not suggest screening asthmatic patients for vitamin D deficiency, but this can be explored in future studies. Also, molecular studies of vitamin D receptors to explain the role of vitamin D supplementation in asthma are needed in future.

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