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Original Research Article

A Study of the Serum Vitamin D Level and its Relation with Severity of Childhood Asthma in Children 1 - 12 Years of Age in the Paediatrics Department of Calcutta National Medical College

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Abstract:

Introduction: Asthma is the most frequent chronic illness in childhood, and like many other chronic conditions, it is likely to have an influence on the social and emotional elements of children's and families' life. India is home to around 15 million of the world's over 200 million asthmatics. Bronchial asthma affects more than 5% of youngsters in their nation, and the burden is steadily growing. Poorly managed asthma is linked to considerable morbidity and socioeconomic issues such as school absenteeism and a low quality of life. Bronchial asthma impacts not just respiratory function, but also the physical, social, and emotional aspects of life

Aims: To assess serum Vitamin D levels in 150 Asthmatic children 1-12 years of age and to study the relation between Vitamin D levels.

Materials and Method: This is an Observational Prospective Study was conducted in Pediatrics Department of Calcutta National Medical College, Kolkata. The study period was March, 2021- February, 2022. 150 patients were included in this study.

Result: It was found that, lower number of patients had Severity of MV Needed (Mechanical Ventilation) [6 (4.0%)] it was statistically significant (p< .00001), (Z=15.9349) and we also found that lower number of patients had Severity of Family H/O Asthma [38 (25.3%)] it was statistically significant (p< .00001).(Z=8.5448).

Conclusion: We concluded that the serum Vitamin D levels was associated with Asthmatic children 1-12 years of age.

Keywords: Asthma, serum Vitamin D levels, Asthmatic and Pediatrics.

Introduction

Asthma is the most frequent chronic illness in childhood, and like many other chronic conditions, it is likely to have an influence on the social and emotional elements of children's and families' life. India is home to around 15 million of the world's over 200 million asthmatics. Bronchial asthma affects more than 5% of youngsters in their nation, and the burden is steadily growing. Poorly managed asthma is linked to considerable morbidity and socioeconomic issues such as school absenteeism and a low quality of life. Bronchial asthma affects not just respiratory function, but also the physical, social, and emotional aspects of life. Studies have revealed greater adaption issues in children with asthma, which have been related to the negative developmental impact of having a chronic disease, psychological stress on the family, and repetitive contacts with medical personnel. Inhaled corticosteroids are preventive medications that minimize the risk of asthma and frequent hospitalization. They have become an essential component of asthma treatment recommendations. Inhaled steroids reduce inflammation, which reduces the need for rescue bronchodilator treatment and hospitalizations, improves pulmonary functions, decreases bronchial hyperresponsiveness, and reduces collagen and tenascin deposition in the airway mucosa. Inhalation therapy has been the preferred treatment due to its numerous benefits. Asthma's specific causation is unclear, however it

most likely stems from complicated interactions between many genetic and environmental variables. There is emerging evidence that Vitamin D deficient asthmatics have a more severe condition and a worse response to therapy. Common risk factors for both asthma and Vitamin D insufficiency, such as an urbanized, westernized lifestyle, race, and obesity, as well as increased knowledge of Vitamin D's immunomodulatory effects, have led to a postulated relationship between rising asthma prevalence and low Vitamin D levels.

Vitamin D's effects on bone metabolism and calcium balance are already well understood. Vitamin D appears to be a major regulator of immunity, acting on both the innate and cell-mediated immune systems. Vitamin D insufficiency has been linked to a variety of immune-mediated illnesses, infections, and cancer. Further research into the role of Vitamin D in lung development and immune system function might have significant implications for asthma prevention and treatment. Human genetic association studies provided the first direct evidence linking vitamin D to the development of asthma and allergies. Increasing data suggests that Vitamin D plays a complicated function in immune response modulation. Vitamin D receptors (VDR) are expressed by a variety of immune cell types, including activated T and B cells, macrophages, and dendritic cells. More recently, Vitamin D has been shown to decrease IL-17 (Interleukin-17) synthesis, which is linked in asthma. Vitamin D suppresses Th2 (T-Helper 2) cells, reducing the synthesis of cytokines including IL-4, IL-5, IL-13, and IgE (Immunoglobulin E) by B cells, mast cells, and eosinophils. As there are no studies available in Indian literature linking the Vitamin D levels and asthma, this study is being conducted to find out the relation between Vitamin D levels and severity of asthma. Some epidemiologic studies, although not all, have found that vitamin D insufficiency is connected with an increased risk of asthma symptoms. Their group has showed that increased maternal intakes of vitamin D during pregnancy are connected with lower rates of recurrent wheezing in young children. [1,2], This suggests that vitamin D may have a role in the development of asthma. However, among people who have established asthma, vitamin D may have a role in the disorder's expression. Results from in vitro investigations [3] suggests that vitamin D may overcome steroid resistance in asthma patients, implying that vitamin D may play a role in asthma management. However, no epidemiological studies have been conducted to investigate the relationship between blood vitamin D levels and asthma severity indicators. The primary objective of this study was to assess serum Vitamin D levels in children aged 1–12 years diagnosed with asthma. Additionally, the study aimed to investigate the relationship between Vitamin D levels and clinical outcomes of asthma, specifically focusing on the severity of the disease and the frequency of asthma exacerbations. By exploring these associations, the study sought to determine whether Vitamin D status could serve as a potential marker or modifiable factor influencing asthma control in the pediatric population.

Materials and Methods

Study Design: Observational Prospective Study

Place of Study: Pediatrics Department of Calcutta National Medical College, Kolkata

Period of Study: One year (March, 2021- February, 2022) after getting clearance from Hospital Ethical Committee and acceptance by West Bengal University of Health Sciences.

Study Population: Children between 1 to 12 years admitted in the Paediatrics Ward of Calcutta National Medical College and Hospital, Kolkata

Sample Size: 150 children

Inclusion Criteria: Children with asthma aged 1 to 12 years diagnosed according to the National Asthma Education and Prevention Program (NAEPP), Expert Panel.

Report 3: Guidelines for the Diagnosis and Management of Asthma. 12.

Exclusion Criteria: Children with other co–morbidities like heart disease, tuberculosis, epilepsy, liver disease, chronic lung disease and renal disease.

Data Collection: Patients diagnosed to have asthma admitted to the Department of Paediatrics, Calcutta National Medical College; Kolkata in the age group of 1 to 12 years was studied. Informed parental consent was taken.

Study Tools

1. Consent from the Parents, detailed history using a structured questionnaire, 2) clinical examination for
2. respiratory distress, shortness of breath,
3. Parents to be advised to maintain an asthma diary that was evaluated during regular follow ups.
4. Following investigations to be done:

- Serum Vitamin D level, complete blood count (CBC), erythrocyte sedimentation rate (ESR), absolute eosinophil count (AEC), and oxygen saturation, chest x-ray, Peak Expiratory Flow Rate (PEFR) and spirometry was done wherever possible.
- Outcome as duration of hospital stay or death sequelae.

Statistical Analysis: For statistical analysis, data were first entered into a Microsoft Excel spreadsheet and subsequently analyzed using SPSS (ver-

sion 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism (version 5). Continuous numerical variables were summarized as mean ± standard deviation, while categorical variables were expressed as counts and percentages. The Z-test (Standard Normal Deviate) was employed to assess significant differences between proportions. For comparisons involving means, the Student's t-test was used, with the corresponding p-value obtained from the t-distribution table. A p-value ≤ 0.05 was considered statistically significant, indicating rejection of the null hypothesis in favor of the alternative hypothesis.

Result

Table 1: Distribution of Severity of Asthma Gina Step 2, 3, 4, 5

		Frequency	Percent
Severity of Asthma Gina Step 2	2	50	100.00%
	Total	50	100.00%
Severity of Asthma Gina Step 3	3	32	100.00%
	Total	32	100.00%
Severity of Asthma Gina Step 4	4	32	100.00%
	Total	32	100.00%
Severity of Asthma Gina Step 5	5	9	100.00%
	Total	9	100.00%

Table 2: Distribution of MV Needed (Mechanical Ventilation) and Family H/O Asthma

		Frequency	Percent
MV Needed(Mechanical Ventilation)	No	144	96.00%
	Yes	6	4.00%
	Total	150	100.00%
Family H/O Asthma	No	112	74.70%
	Yes	38	25.30%
	Total	150	100.00%

Table 3: Distribution of mean Hospital Stay (In Days) and VITD Level

	Number	Mean	SD	Minimum	Maximum	Median
Hospital Stay (In Days)	71	5.1690	2.4842	2.0000	15.0000	5.0000
VITD Level	150	21.7749	21.9180	2.0800	150.0000	16.4100

Table 4: Distribution of mean Asthma Gina Guidelines Step 1, Step 2, Step 3, Step 4 and Treatment Gina Guidelines Step1, 2,3,4,5

	Number	Mean	SD	Minimum	Maximum	Median
Severity Of Asthma Gina Guidelines Step1	27.00	1.00	0.00	1.00	1.00	1.00
Severity Of Asthma Gina Step2	50.00	2.00	0.00	2.00	2.00	2.00
Severity Of Asthma Gina Step 3	32.00	3.00	0.00	3.00	3.00	3.00
Severity Of Asthma Gina Step 4	32.00	3.00	0.00	3.00	3.00	3.00
Treatment Gina Guidelines Step1, 2,3,4,5	149.00	2.63	1.18	1.00	5.00	2.00

Table 5: Distribution of mean with all parameters

	Number	Mean	SD	Mini-mum	Maximum	Median
PEFR On 1st Visit% Of Predicted Pre Brocnchodilator	150	70.2667	8.7044	48	82	72
PEFR On 1st Visit % Of Predicted Post Brochodilator	150	91.5	8.2207	69	100	94
TLC	150	8364.45	2211.27	5003	15670	7848.5
ESR	150	16.2067	12.7001	2	72	13

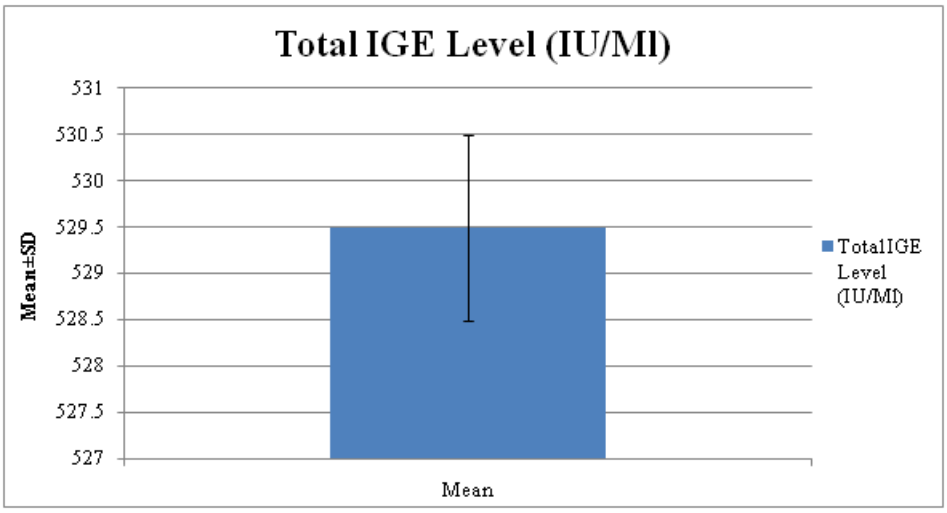

Figure 1: Distribution of Total IGE Level (IU/Ml)

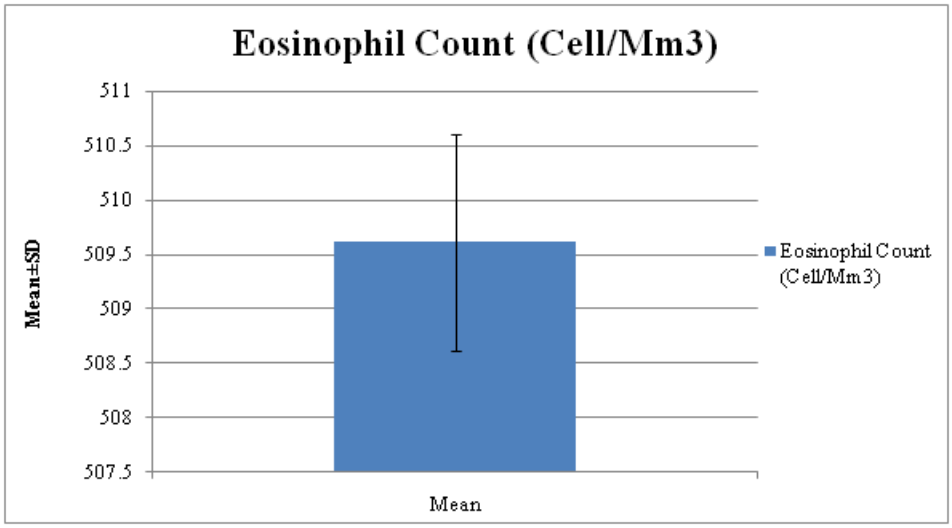

Figure 2: Distribution of Eosinophil Count (Cell/Mm3)

In our study, 27 (100.0%) individuals had severe asthma according to the Gina Guidelines. Step 1: In our study, 50 (100.0%) of the patients had severe asthma. Gina's Guidelines Step 2: In our study, 32 individuals (100.0%) had severe asthma. Gina's Guidelines Step 3. In our study, 32 (100.0%) individuals had Severe Asthma. Gina's Guidelines Step 4: In our study, nine individuals (100.0%) had severe asthma. Gina's Guidelines Step5. In our research, 6 (4.0%) patients required severe mechanical ventilation. The value of z is 15.9349. The value of p is <0.00001. The finding is significant (p <0.05). In our research, 38 patients (25.3%) had Severe Family H/O Asthma. The value of z is 8.5448. The value of p is <0.00001. The result is significant (p < 0.05). The data shows that patients had a mean hospital stay of 5.1690±2.4842 days. The table above shows that the mean Severity of Asthma Gina Guidelines Step1 (mean±SD) of patients was 1.0000±.0000. The table above shows that the mean Severity of Asthma Gina Guidelines Step2 (mean±SD) of patients was 2.0000± 0.0000. The table above shows that the mean Severity of Asthma Gina Guidelines Step 3 (mean±SD) of patients was 3.0000±0.0000. The table above shows that the mean Severity of Asthma Gina Guidelines Step 4 (mean±SD) of patients was 3.0000±0.0000. The following table shows that the mean Treatment Gina Guidelines Step1, 2, 3, and 5 (mean±s.d.) of patients was 2.6309±1.1761. The table above shows that the mean PEFR on first visit% of predicted pre-bronchodilator (mean ± SD) of patients was 70.2667 ± 8.7044. The table above shows that the mean PEFR on first visit% of predicted post-bronchodilator (mean±SD) of patients was 91.5000±8.2207. The table above shows that the mean TLC (mean±s.d.) of patients was 8364.4533±2211.2707. The table above shows that the mean ESR (mean ± SD) of patients was 16.2067 ± 12.7001. The table above shows that the mean Total IGE Level (IU/Ml) of patients was 529.4933±275.4134. The table above shows that the mean Eosinophil Count (Cell/Mm3) of patients was 509.6133±222.8463.

Discussion

This is an Observational Prospective Study was conducted in Pediatrics Department of Calcutta National Medical College, Kolkata. The study period was March, 2021- February, 2022. 150 patients were included in this study.

In our study, out of 150 patients, most of the patients were [85 (56.7%)] ≤5 years of age which was statistically significant (p=.02088).(Z=2.3094).

We found that, male population [78 (52.0%)] was higher than the female population [72(48.0%)] but this was not statistically significant (p.4902). (Z=0.6928).

Chinellato I et al [4](2011) found that to investigate the link between vitamin D blood levels, lung function, and asthma management in children. In a cross-sectional study conducted during the winter and early spring, they investigated the relationship between 25-hydroxy cholecalciferol [25(OH)D] concentrations, baseline spirometry, and levels of asthma control, as measured by the Global Initiative for Asthma guidelines and the Childhood Asthma Control Test, in 75 children with asthma (ages 5-11 years; 43 males). Only 9.4% of their children had appropriate serum 25(OH)D levels (at least 30 to 40 ng/mL).

Chinellato I et al [5](2011) Epidemiological studies have shown a link between low serum vitamin D levels and impaired lung function in healthy people, as well as asthma onset and severity in children.

Our study showed that, only 27 patients had Severity of Asthma Gina Guidelines Step1 and 50 patients had Severity of Asthma Gina Guidelines Step2, 32 patients had Severity of Asthma Gina Guidelines Step3.

It was found that, lower number of patients had Severity of MV Needed (Mechanical Ventilation) [6 (4.0%)] it was statistically significant (p< .00001).(Z=15.9349) and we also found that lower number of patients had Severity of Family H/O Asthma [38 (25.3%)] it was statistically significant (p< .00001).(Z=8.5448).

Gupta A et al [6](2011) found that little is known regarding vitamin D levels and their impact on asthma pathogenesis in children with severe, therapy-resistant asthma (STRA). The relationship with serum vitamin D, lung function, and pathology was examined in pediatric STRA. Serum 25-hydroxyvitamin D [25(OH)D3] was measured in 86 children (mean age, 11.7 yr): 36 with STRA, 26 with moderate asthma (MA), and 24 without asthma (control subjects). Hollams EM et al [7](2011) found that Some studies have connected vitamin D with atopy- and asthma-related characteristics in children with established illness, but its function in disease initiation at the population level is unclear. The current study sought to evaluate the relationship between vitamin D level and biological markers suggestive of allergy and asthma development in children aged 6 to 14 years in Perth, WA, Australia (latitude 32° S). Serum vitamin D levels were measured in 989 6-year-olds and 1,380 14-year-olds from an unselected community birth cohort, with 689 participants evaluated at both ages.

Alyasin S et al (2011) found that Asthma and other allergy illnesses have become more common in almost every country during the last several decades. Much research have revealed that vitamin D insufficiency has a role in both T-helper1 and T-helper2 illnesses; nevertheless, the link between vitamin D, allergy, and asthma is still unclear. In this study, the correlations between 25-hydroxy vitamin D3 levels and asthma severity were investigated. This cross-sectional research included 50 asthmatic children and 50 healthy controls aged 6 to 18 years. Serum 25-hydroxyvitamin D3 levels were measured and compared between the two groups.

We showed that, the mean Age (Yr) of patients was [6.0707±2.5614.], Hospital Stay (In Days) of patients was [5.1690±2.4842], VIT D Level of patients was [21.7749±21.9180.], Severity of Asthma Gina Guidelines Step1 of patients was [1.0000±.0000.], Severity of Asthma Gina Guidelines Step2 of patients was [2.0000±.0000.], Severity of Asthma Gina Guidelines Step 3 of patients was [3.0000±.0000], Treatment Gina Guidelines Step1, 2,3,4,5 of patients was [2.6309±1.1761.], PEFR On 1st Visit% Of Predicted Pre Brocnchodilator of patients was [70.2667±8.7044], PEFR On 1st Visit % Of Predicted Post Brochodilator of patients was [91.5000±8.2207], TLC of patients was [8364.4533±2211.2707], ESR of patients was [16.2067±12.7001], Total IGE Level (IU/Ml) of patients was [529.4933±275.4134] and Eosinophil Count (Cell/Mm3) of patients was [509.6133±222.8463].

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