ORIGINAL RESEARCH

Study of Vitamin D levels in Patients with Recurrent Respiratory Infections

¹Dr. Aditi Rajan, ²Dr. Shubham Mishra, ³Dr. Virendra Atam

¹Senior Resident, ³Professor & Head, Department of Medicine, King George Medical University, Lucknow, Uttar Pradesh, India

²Assistant Professor, Department of Orthopaedics, Shyam Shah Medical College, Rewa, Madhya Pradesh, India

Corresponding Author

Dr. Aditi Rajan

Senior Resident, Department of Medicine, King George Medical University, Lucknow, Uttar Pradesh, India

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ABSTRACT

Background: Respiratory tract infections (RTIs) continue to be one of the significant factors contributing to illness and death in patients . Numerous studies have linked vitamin D deficiency to a higher risk of RTIs, leading to the consideration of vitamin D supplementation as a potential preventive strategy against RTIs in patients . To study vitamin D levels in patients with recurrent respiratory infections. **Materials & Methods:** 100 subjects were enrolled. The age was between 5 months to 15 years, who were either admitted or attending as outpatients due to recurrent respiratory infections, were enrolled as cases. The proportions were analyzed using the chi-square test. The p-value of less than 0.05 was considered statistically significant. **Results:** The average age of the cases and controls was 70.56 months and 55.4 months, respectively. Among the cases, 80% were found to be deficient in vitamin D, while 20% exhibited insufficient vitamin D levels. **Conclusion:** Patients experiencing recurrent respiratory infections showed a significantly elevated incidence of vitamin D deficiency when compared to the control group.

Keywords: Vitamin D, Respiratory infections, vitamin D deficiency.

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INTRODUCTION

By definition, vitamin D is not a true vitamin since adequate exposure to sunlight either negates or significantly diminishes the need for dietary supplementation. Instead, this imprecise descriptor refers to a group of steroid molecules also encompassing both vitamin D2 (derived from plants that utilize ergosterol rather than cholesterol) and vitamin D3 molecules (derived from cholesterol). The human body thus procures vitamin D through two independent pathways: the photochemical action of solar UVB light (≈ 295 to 320 nm) in the skin and some limited dietary sources. ¹ In the body, 25D (25hydroxy vitamin D) is the major circulating vitamin D metabolite. It is generated predominantly through hepatic 25-hydroxylation via many potential catalysts, including CYP2R1 and CYP27A1. The conversion to hormonal 1,25D (1,25-dihydroxyvitamin D) requires the enzyme CYP27B1. The kidneys have long been considered the major site for 1a-hydroxylation of 25D to 1,25D. Unlike the loosely regulated hepatic hydroxylation of 25D, the renal 1α -hydroxylation falls under tight control of PTH (parathyroid hormone) and is primarily involved in calcium regulation and signaling. In sites other than the renal tubule

(keratinocytes, the trophoblastic layer of the placenta, IFN- γ stimulated macrophages, and granulomata, this type of fastidious regulation is either absent or operates very inefficiently. Compared to adults, strict control of renal 1 α -hydroxylation and the normal feedback suppression by 1,25D is also less precise in infants.²⁻⁴

Respiratory tract infections in patients are commonly encountered in clinical practice. These infections are one of the most frequent reasons for consulting a physician and contribute significantly to childhood morbidity and mortality. Globally, deaths across all age groups due to respiratory tract infections were reported to be 2.65 million in 2013. ^{5,6} India, Bangladesh, Indonesia, and Nepal accounted for 40% of the global acute respiratory infection mortality.⁷ Reports suggest that patients under five years of age suffer about five episodes of acute respiratory infection per year. Moreover, acute respiratory infections are a leading cause of deafness as sequelae of acute otitis media.⁷ There is a need to identify the modifiable factors that can impact the prevalence and management of respiratory infections among patients . Vitamin D deficiency modulates the immune mechanisms associated with the risk of respiratory infections during childhood. Vitamin D levels are significantly lower among patients with recurrent respiratory tract infections. Studies have suggested further exploring the relationship between vitamin D deficiency and respiratory infections in patients .^{8,9} Hence, this study was conducted to examine vitamin D levels in patients with recurrent respiratory infections.

MATERIALS & METHODS

The present study was conducted to examine vitamin D levels in patients with recurrent respiratory infections.100 subjects were enrolled. The age was between 5 months to 15 years, who were either admitted or attending as outpatients due to recurrent respiratory infections, were enrolled as cases. 50 healthy patients of the same age group, visiting the hospital for vaccination and routine check-ups during

the study period, were included as controls. To investigate the serum 25-hydroxyvitamin D levels, venous blood samples were collected from both the cases and controls. The proportions were analyzed using the chi-square test. The p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 150 subjects were enrolled. They were divided into 2 groups as cases were 100 subjects and 50 were controls. The average age of the cases and controls was 70.56 months and 55.4 months, respectively. Among the cases, 80% were found to be deficient in vitamin D, while 20% exhibited insufficient vitamin D levels. The contrast in the proportions of vitamin D sufficiency between cases and controls was statistically significant (p < 0.001).

Table 1: Age distribution

Age (months)	Groups		Total	
	Case	Controls		
60 or less	50 (50%)	30 (60%)	80(53.3%)	
61-120	40 (40%)	17 (34%)	57 (38%)	
>120	10 (10%)	3 (6%)	13(8.7%)	
Total	100	50	150	

Table 2: Vitamin d in both groups

Group	25- hydroxyl vitamin D			Total
	Sufficient	Insufficient	Deficient	
Control	33 (66%)	12(24%)	5 (10%)	50
Case	0	20(20%)	80 (80%)	100
≥6 respiratory infections per annum	0	10 (25%)	30 (75%)	40
\geq respiratory infection/s per month	0	8 (24.3%)	25 (75.7)	33
involving the upper airways				
\geq 3 respiratory infections per annum	0	2 (28.5%)	5 (71.4%)	7
involving lower airways				
otitis media 3 episodes within 6	0	1 (33.3%)	2 (66.6%)	3
months/4 episodes within 12 months				
recurrent infectious rhinitis >5	0	3 (25%)	9 (75%)	12
episodes per year				
recurrent pharyngitis or tonsillitis,	0	1 (20%)	4 (80%)	5
i.e., more than three episodes within				
12 months				

DISCUSSION

Vitamin D, or the "sunshine vitamin," is not just a vitamin; it is also a prohormone with numerous functions in the body. ¹⁰ "Prohormone" refers to a group of fat-soluble secosteroids. The two major forms are vitamin D2, or ergocalciferol, and vitamin D3, or cholecalciferol. ¹¹ The best-understood function of vitamin D is in the absorption of calcium from the small intestine, which helps to prevent diseases such as osteoporosis and osteomalacia in adults and rickets in patients . ¹²⁻¹⁴ In addition to its important role in skeletal development and maintenance, there is increasing evidence that vitamin D has a beneficial effect on extraskeletal tissues.

Tissues such as the brain, heart, stomach, pancreas, lymphatics, skin, gonads, and prostrate tissue are composed of cells, including T and B lymphocytes, that express the vitamin D receptor (VDR). In these tissues, vitamin D is thought to have roles in the improvement of immune function and the reduction of inflammation. ¹⁵ Accordingly, there is accumulating evidence that consumption of vitamin D may reduce respiratory tract infection (RTI) susceptibility in patients . ¹⁶ Initially, the prototypical disease link was tuberculosis (TB), but there are now studies that support a connection with several others RTIs, such as acute otitis media (AOM), pharyngotonsillitis, rhinosinusitis, bronchiolitis and pneumonia.¹⁷ Hence,

this study was conducted to examine vitamin D levels in patients with recurrent respiratory infections.

In the present study, a total of 150 subjects were enrolled. They were divided into 2 groups as cases were 100 subjects and 50 were controls. The average age of the cases and controls was 70.56 months and 55.4 months, respectively. A study by Ozdemir B et al, mean serum 25(OH) vitamin D level in the recurrent respiratory infections group was 11.97 ± 4.04 ng/ml, chronic cough group was 13.76 ± 4.81 ng/ml and control group was 31.91 ± 18.79 ng/ml. Comparison of serum 25(OH) vitamin D levels between the study groups revealed a statistically significant difference (p < 0.05). 25(OH)D deficiency in patients was associated with increased frequency of recurrent respiratory infections and chronic cough. Administration of supplementary vitamin D may be useful in the treatment and preventation of recurrent respiratory infections and chronic cough. 18

In the present study, among the cases, 80% were found to be deficient in vitamin D, while 20% exhibited insufficient vitamin D levels. The contrast in the proportions of vitamin D sufficiency between cases and controls was statistically significant (p < p0.001). Another study by Dabrowska- Leonik N et al, the tests showed that 11% of patients presented IgG levels below the age related reference values. Patients with reduced IgG concentration were also found to have significantly lower vitamin D concentrations in comparison to patients with normal IgG. Vitamin D deficiency was observed in schoolpatients between 7 and 18 years of age. No correlation was found between 25(OH)D concentration and Hbs antibody levels. An investigation of a large group of patients who have recurrent infection found patients with IgG deficiency to whom special proceeding have to be performed: 1. Significantly lower vitamin D concentration observed in the group of patients with IgG deficiency implicated in long-lasting monitoring of vitamin D level require adding to the practice guidelines for Central Europe 2013. 2. Intervention treatment with suitable doses of vitamin D to clarified metabolism of vitamin D has to be plan for patients with IgG deficiency and significant lower vitamin D concentration. ¹⁹Jaybhaye AP et al, the mean age of the cases and controls was 68.25 ± 40.3 months and 52.6 ± 40.9 months, respectively. Among the cases, 25% were vitamin D deficient and 75% had vitamin D insufficiency. The difference in proportions of vitamin D sufficiency status among cases and controls was statistically significant (p < 0.001). There was a very high prevalence of vitamin D deficiency among patients with recurrent respiratory infections compared to controls. The vitamin D status assessment should be included in the management of patients with recurrent respiratory infections. 20 Most American patients may not be going outside enough to meet their vitamin D3 needs from sun exposure.²¹ Recent estimates from everyday outdoor exposure suggest that patients (≤ 5 years) in the northern ($45^{\circ}N$) and southern (35°N). United States with Fitzpatrick Type II skin (Caucasian) can have adequate skin synthesis of vitamin D3 during the summer and patients living in the south during the spring as well but only if they do not wear sunscreen at all except during beach vacations. ²² Patients with Fitzpatrick Type III and IV skin (olive tone-Hispanic/Asian or brown tone-Indian, respectively) can only synthesize the suggested minimum daily recommendation during the summer months, while those with the darkest pigmentation (skin type V and higher, usually African-Americans) never make the suggested minimum amount of vitamin D3 from sun exposure.²¹ These vitamin D3 estimates from solar exposures assume certain skin types, liberal clothing scenarios during each season and that sunscreens are not worn except during beach vacations. These could be overestimates for infants and toddlers since mothers tend to be overly protective of their patients to avoid skin cancer later in life or could be a result of patients spending more time indoors watching television. Despite the fact that younger patients are spending more time indoor, patients in the younger age group $(\leq 5 \text{ years})$ have more cutaneous vitamin D synthesis than those in the older age groups.²³

CONCLUSION

Patients experiencing recurrent respiratory infections showed a significantly elevated incidence of vitamin D deficiency when compared to the control group. Therefore, evaluating the vitamin D status should be an essential part of managing patients with recurrent respiratory infections.

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