

Vitamin D and Recurrent Respiratory Tract Infection in Children Under Five Years at a Tertiary Hospital

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Abstract: ***Introduction:** Recurrent infections in children are a leading cause of physician visits and hospitalizations, resulting in significant morbidity, mortality, school absences, and parental work loss. Among the various factors, Vitamin D plays a crucial role in disease prevention and severity reduction. This study aims to explore the relationship between Vitamin D levels and recurrent respiratory infections in children under five years, focusing on prevention strategies to reduce pediatric morbidity. **Aims and Objectives:** 1) To assess serum Vitamin D levels in children under five with recurrent respiratory tract infections. 2) To determine the association between Vitamin D deficiency and recurrent respiratory tract infections. **Methods:** The study was conducted in children under five with RRTI attending the Paediatrics Department at KVG Medical College and Hospital. Data were collected and analysed. **Results:** A total of 106 children were evaluated, including 62 cases with RRTI and 44 controls with other complaints (NONRRTI). Most were aged 4-5 years, with female preponderance. Common conditions included bronchopneumonia, HARD, and recurrent tonsillitis. A history of Vitamin D deficiency was observed in 87% of cases. **Conclusions:** RRTIs contribute significantly to pediatric morbidity and mortality. Vitamin D, with its immunomodulatory effects, can help prevent respiratory infections, reduce severity, and lower mortality rates.*

Keywords: Vitamin D, recurrent respiratory infections, pediatric health, malnutrition, immunomodulation

1. Introduction

The Italian Society of Paediatrics defines RRTIs as either >6 RTIs per year or >1 RTIs per month involving the upper airways (URTI) from September to April - or >3 RTIs per year involving the lower airways (LRTI).¹

Epidemiological data shows that 15% of children suffer from RRTIs with a consequent significant cost for both families and the wider society. Several factors have been related to the occurrence of RRTIs: relative immaturity of the immune system, domestic and environmental pollution, atopy and virus infections. Despite RTIs being due mainly to viral infections, bacterial super-infections which are aggravated by increasing antibiotic resistance, occur more frequently nowadays.

The socioeconomic impact of these recurrent infections is also staggering, and there remains much scope for devising methods for their treatment and prevention².

Vitamin D is a group of fat-soluble pro-hormones, the two major forms of which are vitamin D2 (or ergocalciferol) and vitamin D3 (or cholecalciferol).

Vitamin D regulates the activity of various immune cells, including monocytes, dendritic cells, T and B lymphocytes, and immune functions of epithelial cells³.

The vicious cycle of pediatric malnutrition, immunodeficiency, and infection has long been recognized as a major cause of childhood morbidity and mortality⁴.

Nutritional deficiency, especially in the earlier years, often include nutritional rickets and this leads to several recurrent

infections including respiratory infections and hence simple interventional steps by practitioners and health workers at the community level can prevent the disease burden^{5,6}. Understanding the link between Vitamin D deficiency and RRTIs can inform public health interventions and clinical practices to reduce the disease burden in children under five.

2. Materials and Methods

Design: Case-control study of RRTI in 1-month to 5-year-olds at KVG Medical College, Sullia.

Source of Data: Patients with recurrent respiratory tract infections (RRTI) attending Pediatrics from Nov 2019-Apr 2021.

Cases were RRTI patients; controls were same-age children attending for other reasons.

Inclusion Criteria:

- Age 1 month-5 years, both genders.
- ≥ 6 respiratory infections/year, ≥ 1 /month (upper airway), or ≥ 3 /year (lower airway).

Exclusion Criteria:

- Age outside 1 month-5 years, congenital heart disease, recent Vitamin D supplementation.

Methods: History, physical examination, and Vitamin D analysis. Chest X-ray for suspected LRTI.

The study was conducted after getting clearance from ethical committee and followed by proforma given to patients for detailed consent. Data was taken and examination carried out with investigations.

Statistics: Data analyzed using SPSS v11.5. Chi-square test; p <0.05 significant.

collection and analysis as per our methodology following results were obtained.

3. Results

This was a case-control study in which 106 children were enrolled with 62 as cases (with recurrent respiratory infections) and 44 as controls attending the OPD and admitted cases for some other reasons (NONRRTI). Based on data

When the age distribution of the children in cases was considered, the major portion of the proportion belong to 4 year-5 years (25%) and followed by 2-3-year-old (22.8%) and then <1 year contributed to 19% followed by 3-4 years constituting 17.7% and 1-2 year comprising 14% of cases. Even in the controls opted the percentage remained the same-24% belonging to 4-5 years followed by 2-3 years (22%),3-4 years and <1 year (22% each), and 1-2 years comprising 12%.

Table 1: Incidence of RRT-with age group division

Age Group	RRTI (Cases n=62)		NON-RRTI (Control n=44)		Total (N=106)	
	Number Of Patients	%	Number Of Patients	%	Number Of Patients	%
< 1 Year	12	19.35	10	22.72	22	20.75
≥ 1 – 2 Year	9	14.51	5	11.36	14	13.20
≥2– 3 years	14	22.58	9	20.45	23	21.69
≥3 – 4 Years	11	17.74	11	25.0	22	20.75
> 4 Years	16	25.80	9	20.45	25	23.58
Total	62	100.0	44	100.0	106	100.0

Cases of RRTI were classified based on common presentation observed in our department last year. Out of the 62 cases, bronchopneumonia was the highest with 26 cases (23 having vitamin D deficiency), HRAD being next with 15 children affected (13 with vitamin D deficiency and 2 being normal levels). There were 6 kids with bronchiolitis clinical picture of which 4 had vitamin D deficiency. There were 5 kids with lobar pneumonia of which all were vitamin D deficient. WALRI was symptomatically present in 4 kids with all being vitamin D deficient. Tonsillitis was clinically diagnosed in 5 similarly of which 4 had deficiency on blood investigation. Tracheobronchitis was present in only one child and this child also had concomitant vitamin D deficiency.

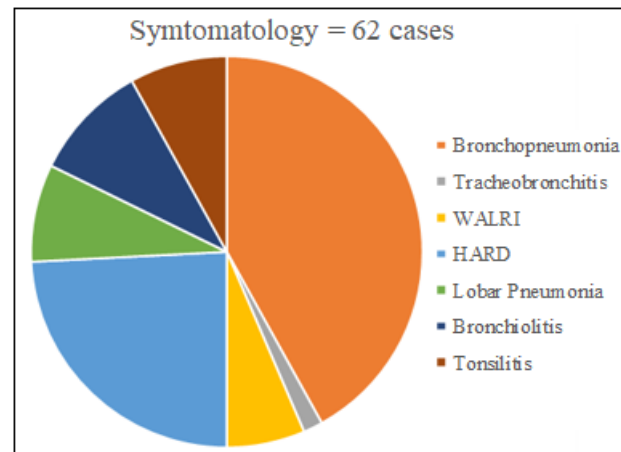


Figure 2: Distribution Of Disease Spectrum Among the Case Population

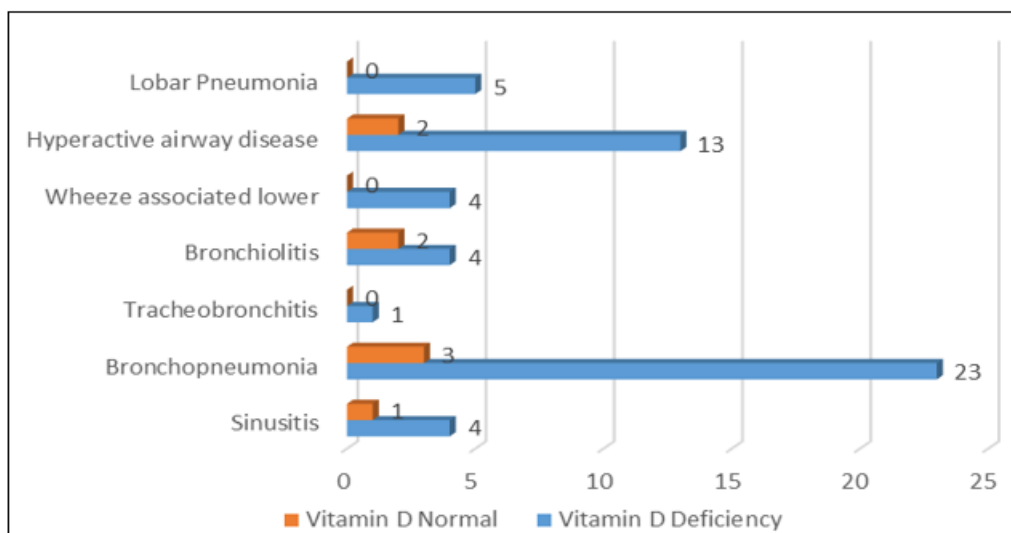


Figure 3: Symptomatology With Vitamin D Deficiency Distribution

Upon analyzing the vitamin D status in both the cases and controls,87% of cases had vitamin D deficiency while 13 didn't have a deficiency. Among the controls,70 had vitamin d deficiency while 36 didn't have. The p-value is <0.05 which

is highly statistically significant showing a strong positive correlation between vitamin d deficiency and recurrent respiratory infections.

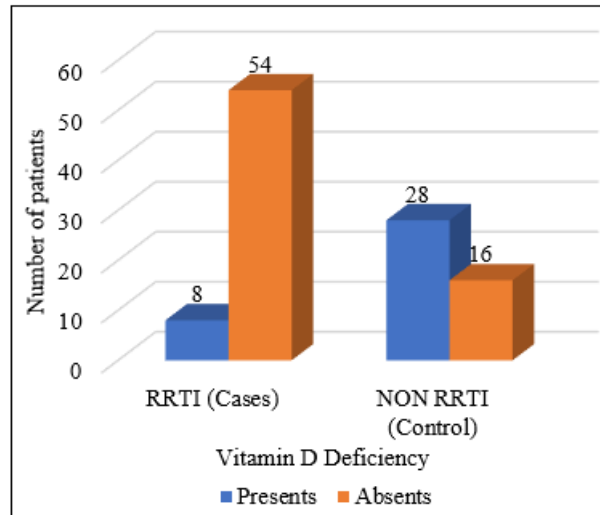


Figure 41: Vitamin D Deficiency Distribution of The Study Population

*Vitamin D Deficiency	RRTI (Cases n=62)		NON-RRTI (Control n=44)		Total (N=106)	
	Number of Patients	%	Number of Patients	%	Number of Patients	%
Presents	54	87.09	16	36.36	70	66.03
Absents	8	12.90	18	40.90	36	33.96
Total	62	100.0	44	100.0	106	100.0

Chi-Square =29.53, p-value=0.000(p<0.05), Highly Statistically Significant

Figure 5: Vitamin D Deficiency Distribution of The Study Population

4. Discussion

In pediatric recurrent infections, age is an important factor in the prediction of mortality and morbidity. In the current study, performed in children under the age of five years, among the majority of kids belonged to 4–5-year group in cases (72%) and 2-3 years (32%) in the control group. The number is the same as the study by ozmedir et al⁷ and J. Zhang et al⁸ with similar age proportions in both controls and cases. Infants and early childhood age are more prone to respiratory infections and recurrence not only because of the less mature immune system but also inefficient clearance of secretions.

Distribution of the Disease Spectrum

The distribution and selection done based on cases commonly reported to our hospital in recent years based on old documents were taken. Bronchopneumonia constituted the major symptomatology comprising 42% followed by HARD and bronchiolitis. Those were similar to the results in studies by Ruhi et al.⁹ Studies by ozmedir et al had more other symptomatology like otitis media and more cases of lobar consolidation.

Vitamin D Deficiency of Study Population

The vitamin D levels in the cases and controls upon analysis had a high statistical significance similar to other studies by Ruhi et al and ozmedir et al the levels showing a more incidence of vitamin d deficiency in the control group of children recurrent respiratory infections than those children who were normal with the respiratory component(control).

Study by ways et al¹⁰. showed a similarly high incidence of vitamin d deficiency including the subclinical ones associated with more episodes of respiratory infections.

A study conducted by Sujata et al¹¹ showed a decline in the incidence of a hospital visit and incidence of ARTI after

supplementing with vitamin d and hence proving the same relation.

This study is an eyeopener for the clinicians, governmental health policies, and parents regarding the importance of aiming adequate nutrition, outdoor exposure and ensuring supplementation of micronutrients like vitamin D.

5. Conclusion

Recurrent respiratory tract infections impose significant challenges on pediatric health. This study highlights the critical role of Vitamin D in reducing the frequency and severity of these infections. Strengthened nutritional programs and public health policies are essential to address hidden hunger and improve pediatric outcomes.

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