



Serum vitamin D profile in children with severe pneumonia: A prospective study in a rural institute

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Abstract

Background: Vitamin D plays a vital role in the maturation of the skeletal system and immunological functions especially by receptor sensing and signaling. The stable form of vitamin D in the body is 25-hydroxycholecalciferol which is often used as its biomarker.

Methods: The study was done prospectively in the pediatric wards, Rajah Muthiah medical college, and hospital, Chidambaram from October 2016 to June 2018. Out of the 200 children with respiratory compliance, 46 children who fulfilled inclusion and exclusion criteria are included in our study. Using a pre-defined proforma, data were collected and the study population was categorized as children having broncho-pneumonia and lobar pneumonia. SPSS software was used for statistical analyses.

Results: Pneumonia was 1.8 times more common in male children than the female. Majority of children had bronchopneumonia (n=28) followed by lobar pneumonia (n=18) based on clinical examination, laboratory and imaging studies. The mean duration of stay in the hospital is 5.8±.51 days.

Conclusion: Prevalence of vitamin D insufficiency among children with pneumonia is 78.26%.

Keywords: Acute lower respiratory tract infection, 25-hydroxycholecalciferol, pneumonia, bronchiolitis.

Introduction

Vitamin D plays a vital role in the maturation of the skeletal system and immunological functions especially by receptor sensing and signaling. However, the immune-modulating effects of vitamin D are not fully understood⁽¹⁾. The stable form of vitamin D in the body is 25-hydroxycholecalciferol (Vitamin D) which is often used as its biomarker. Serum levels of

vitamin D are interpreted as deficient, insufficient and sufficient if the values are <50, 50-75 and 76-200 nmol/L respectively⁽²⁾. However, the values should cautiously interpret in the children with disease because it is known to be reduced in illness. So, it is often regarded as a possible negative acute phase reactant⁽³⁾. Acute lower respiratory tract infection (ALRI) is the leading cause of fatality among under-fives in the world.

The course of the ALRI is usually preceded by upper respiratory tract infection which evolves into latter^(4,5). In neonates, cord blood vitamin D <20 ng/mL can be considered as a risk factor for developing respiratory syncytial viral bronchiolitis in the infantile period⁽⁶⁾. Cathelicidin, an intracellular antimicrobial peptide is involved in killing of microbes including viruses can be increased by active forms of vitamin D⁽⁷⁾. The recommended dietary allowance is 400 and 600 IU per day in infant and children older than a year respectively⁽⁸⁾. Children with inherent vitamin D polymorphisms with *FokI* minor allele has increased odds of getting RSV bronchiolitis⁽⁹⁾.

Methods

The study was done prospectively in the pediatric wards, Rajah Muthiah Medical College and Hospital, Chidambaram from October 2016 to June 2018. Children aged two months not more than five years with a clinical diagnosis of acute lower respiratory tract infection were included in the study. Children with severe malnutrition, on any multivitamin medication with vitamin D combination or vitamin D supplementation, having co-existing hepatic, renal, cardiovascular disease, diabetes mellitus, and chronic pulmonary conditions like bronchiectasis, cystic fibrosis, and bronchial asthma was not included. Out of the 200 children with respiratory compliance, 46 children who fulfilled inclusion and exclusion criteria are included in our study. Using a pre-defined proforma, data were collected and the study population was categorized as children having broncho-pneumonia and lobar pneumonia. By sterile venepuncture technique, 2 mL of blood was withdrawn in a plain and ethylenediaminetetra-

acetic acid vacutainer for serum vitamin D, Calcium, C- reactive protein, and complete haemogram respectively. The transport time of sample for analysis was done less than an hour. SPSS software was used for statistical analyses.

Results

ALRI was 1.8 times more common in male children than the female. Children had a cough (n=46), fever (n=33) and the refusal of feeds (n=22) as primary complaints of informant during the presentation. Tachypnoea (n=45), chest retractions (n=43), nasal flaring (n=39), crepitations (n=36), grunting (n=32), and bronchial breathing (n=7). As per Universal Immunisation schedule, 71.74% (n=33) were recognized as immunized for age. Majority of children had bronchopneumonia (n=28) followed by lobar pneumonia (n=18) based on clinical examination, laboratory and imaging studies. The mean duration of stay in the hospital is 5.8±.51 days with the range (3, 8). Total leucocyte count was elevated in 54.35% (n=25) with neutrophils remains predominant in 71.74% (n=33). Acute phase reactant was elevated in 60.87% (n=28) in terms of highly sensitive C reactive protein assay. Renal function test (Serum urea with creatinine) was found to be normal in all children. Calcium levels were found to be adequate in 86.7% (n=65). Mean vitamin D levels in infants was 28 ± 16 ng/ml, 23 ± 9 ng/ml in toddlers and the lowest mean vitamin D levels are found in pre-school children (22 ± 10 ng/ml) with lobar pneumonia. The risk factors namely low birth weight, pollution, overcrowding, parental smoking, and poor smoking were found to be not associated with a specific subgroup of pneumonia.

Table- 1: Demographic details and feeding distribution		
Age (years)	Number (n)	Percentage (%)
< 1	12	26.09
1-3	22	47.83
3-5	12	26.09
Sex	Number (n)	Percentage (%)
Male	30	65.3
Female	16	34.7

Socioeconomic status	Number (n)	Percentage (%)
Upper	2	4.35
Upper middle	4	8.70
Upper lower	5	10.87
Lower middle	29	63.04
Lower	5	10.87
Immunisation status	Number (n)	Percentage (%)
Immunized	33	71.74
Partially Immunised	12	26.09
Unimmunized	1	2.17
Exclusive breastfeeding	Number (n)	Percentage (%)
Present	26	56.52
Absent	20	43.48
Weaning started	Number (n)	Percentage (%)
< 6 months	11	23.91
6-7 months	24	52.17
>7 months	11	23.91
Bottle feeding	Number (n)	Percentage (%)
Present	33	71.74
Absent	13	28.26

Table-2: Investigation parameters distribution

Hb (g/dl)	Number (n)	Percentage (%)
< 10	21	45.65
10 – 14	24	52.17
>14	1	2.17
Total Leucocyte count	Number (n)	Percentage (%)
Increased	25	54.35
Normal	21	45.65
Differential count	Number (n)	Percentage (%)
Lymphocytes	13	28.26
Neutrophils	33	71.74
CRP	Number (n)	Percentage (%)
Positive	30	65.22
Negative	16	34.78
Serum calcium (mg/dl)	Number (n)	Percentage (%)
Reduced	6	13.04
Normal	40	86.96
Vitamin D (ng/ml)	Number (n)	Percentage (%)
<10	2	4.35
10 - 30	33	71.74
>30	11	23.91

Table 3: Relationship between vitamin D levels and lower respiratory tract infection

Vitamin D (ng/dl)	Diagnosis				Total	
	Broncho-Pneumonia		Lobar pneumonia		N	%
	N	%	N	%		
< 10	0	0.00	2	4.35	2	4.35
10-30	22	47.83	12	26.09	34	73.91
>30	6	13.04	4	8.70	10	21.74
Total	28	60.87	18	39.13	46	100

Discussion

Adequate levels of vitamin D in foetal life is associated with reduced risk of chronic respiratory diseases with wheezing the early childhood period. The severity of any condition is increased when there is co-existing vitamin D deficiency⁽¹⁰⁾. Cord blood and maternal vitamin D levels at delivery were associated with correlation coefficient of 0.79. It is expected to decrease over time⁽¹¹⁾. Vitamin D insufficiency is common in high altitude and low latitude countries due to decreased production. The decreased production has been attributed to the low sunlight exposure in these countries⁽¹²⁾. Antimicrobial peptide (LL-37) is up regulated by vitamin D response elements in monocytes and respiratory epithelium. These peptides in tracheal secretions is the source of innate immunity against respiratory infections⁽¹³⁾. Vitamin D status and respiratory diseases were positively correlated among Indian children and Turkish new-borns. But there is no correlation found in Canadian children and infants⁽¹⁴⁾. Single nucleotide polymorphisms in vitamin D receptors namely *FokIff* and *FokIFF* associated with ARLI. Relative adjusted odds of *FokIff* was 7 times higher than that of *FokIFF*⁽¹⁵⁾.

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