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“Association of Vit D with severity of acute lower respiratory tract infection among hospitalized children between 6 months to 5 years of age”

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Abstract:

Introduction: Acute lower respiratory tract infection, is the leading cause of morbidity & mortality world-wide in children age less than 5 years. Clinically vit. D deficiency is associated with 13fold increasing risk of pneumonia, in children less than 5 years of age. **Objective:** To estimate the Vit D levels in children with acute lower respiratory tract infections in 6 months to 5 year of age group. **Methods:** This is hospital based observational study, carried out in department of Pediatrics Mahatma Gandhi Medical College & Hospital, Jaipur, Rajasthan. All patients between 6 months to 5 years of age who presented with symptoms of acute lower respiratory infections were included. **Result:** A total of 107 study subjects were included in the study. Vit D deficiency and insufficiency were found among 51.4% and 29.9% of the subjects, respectively, while it was found to be normal in 18.7 % of the subjects. **Conclusion-** This study was conducted as an attempt to show the importance of sun light exposure among young children and to increase its social awareness among mothers and in general, the entire society.

Keywords: BMI (Body Mass Index), ESPGHAN, CLD

Introduction:

Acute lower respiratory tract infection (ALRTI), such as pneumonia and bronchiolitis, is the leading cause of morbidity and mortality worldwide in children less than age 5 years.

Table 1:ALRI Case Definitions[2]

Diagnosis	Criteria
Pneumonia	Patient under 5 years Temperature $>38^{\circ}\text{C}$ Consolidation on chest radiograph Tachypnea*
Bronchiolitis	Patient under 2 years of age Absence of consolidation on chest radiograph [†] Audible wheeze and/or crepitation on auscultation Tachypnea*

*Respiratory rate of 60 breaths per minute for children aged 0-2 months, 50 breaths per minute for children age 3-12 months, 40 breaths per minute for children aged 13-60 months; [†]Radiograph interpreted independently by two physicians.

- Severity of respiratory illness as defined by WHO [3]:
(Pneumonia, Severe Pneumonia and Very Severe Pneumonia)
 - **Pneumonia**- Respiratory Rate fast than ($>60/\text{min}$ in babies below 2 months, $>50/\text{min}$ in infants between 2 -12 months and $>40/\text{mins}$ in babies $>12\text{-}60$ months).
 - **Severe pneumonia** – chest wall retraction along with fast respiratory rate.
 - **Very Severe Pneumonia**- Presence of any danger sign with respiratory symptoms namely decrease oral acceptance, persistent vomiting, seizures or altered sensorium along with chest wall retraction and fast respiratory rate.

Reports suggested that children under five years of age suffered about five episodes of acute respiratory infection per year [4-7]. Moreover, acute respiratory infections are the leading cause of deafness as sequelae of acute otitis media. There is a need to identify the modifiable risk factors that can impact the prevalence and management of respiratory infections among children[8].

Risk factors for the development of ALRTI includes low birth weight, non exclusive breastfeeding, incomplete immunization, indoor air pollution, crowding, parental smoking, and chronic disease [9].

Vitamin D is a fat-soluble vitamin which is an important micro-nutrient for growth and development. Both vitamin D2 and vitamin D3 can be obtained from the diet. [11-12]

Vitamin D supplementation appears to reduce the incidence of ALRTI and adverse outcomes associated with these conditions.

Serum or plasma level of total 25(OH)D is currently used as the indicator of Vit. D status (13). Almost all professional associations define Vit.D status as sufficient, when the level of 25(OH)D is at least 30 ng/mL, insufficient at 21–29 ng/mL and deficient at 20 ng/ml,

Aim and Objectives:

To estimate the Vitamin D level in children with acute lower respiratory tract infection in 6 months to 5 years of age & its correlation with severity of ALRTI.

Material and Methods:

Study Design:

Hospital based observational study.

Setting:

Department of Pediatrics Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan.

Duration of the study:

August 2022-December2023

Types of subjects:

All patients between 6 months to 5 year of age who presented to department of Pediatrics with symptoms of acute lower respiratory tract infection between August 2022-December 2023.

Sample size:

All patients who came to department of Pediatrics with symptoms of acute lower respiratory tract infection who fulfilled the inclusion & exclusion criteria for period of August 2022- December 2023 were included in the study .

Inclusion Criteria:

- a. Children between six months to five years of age.
- b. Children admitted in department of Pediatrics with diagnosis of ALRTI.
- c. Children whose parents had given consent for participation.

Exclusion Criteria:

- d. Children on Vitamin D supplements.
- e. Children on anticonvulsants, antitubercular and glucocorticoids drugs.
- f. Children with congenital skeletal disorders, congenital heart diseases, congenital lung disorders, chronic diarrhea and malabsorption syndrome.

Methods

2. It was an observational study conducted among children between six months to five years of age who came to department of Pediatrics of Mahatma Gandhi Medical college & hospital, Jaipur with symptoms of lower respiratory tract infection.
3. A record of clinical profile was made using predesigned proforma after obtaining consent.
4. Acute lower respiratory tract infection was diagnosed on the basis of clinical criteria (fever,cough,tachypnea and respiratory distress)
5. Tachypnea was defined as follows (as per WHO) ⁶

Age	Respiratory Rate
0-2 Months	>60 Breaths/min
>2-12 Months	>50 Breaths/min
>12-60 Months	>40 Breaths/min

Respiratory distress: increase work of breathing

- Nasal flaring
- Raised respiratory rate
- Grunting
- Retraction(chest wall,supra-sternal & subcostal retractions)
- Difficulty in breathing

Severity of respiratory illness as defined by WHO [15]:

(Pneumonia, severe pneumonia and very severe Pneumonia)

- Pneumonia- Respiratory Rate fast (>60/min in babies below 2 months, >50/min in infants between 2-12 months and >40/min in babies >12-60 months)
- Severe pneumonia – if beside fast respiratory rate, chest wall retraction also present

- Very Severe Pneumonia- Presence of any danger sign with respiratory symptoms namely decrease oral acceptance, persistent vomiting, seizures or altered sensorium along with chest wall retraction and fast respiratory rate

■

Investigations done for confirmation of ALRTI :

CBC, CRP, ESR, X-RAY chest and other clinically relevant tests were conducted.

Serum level of 25(OH)D was assessed by CLIA (Chemiluminescence immunoassays).

Following cut off values were taken for 25 OH Vitamin D levels [14] –

1. Normal value of vitamin D taken as > 30 ng /ml
2. Insufficiency as 20 to 30 ng/ml
3. Deficiency as < 20ng/ml

Data was collected and subjected to statistical analysis.

Statistical analysis:

Data collected was tabulated in an excelsheet, under the guidance of statistician. The mean and standard deviation of the measurement per group were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). For each assessment point, data were statistically analyzed using Chi -Square test and the level of significance was set at $p < 0.05$.

Discussion:

The present hospital based observational study was conducted in the department of Pediatrics Mahatma Gandhi Medical College and Hospital, Jaipur, Rajasthan during August 2022-December 2023. A total 107 children between 6 month to 5 year were presented to department with symptoms of acute lower respiratory tract infection.

Gender and Age:

Male and female children ratio was 66.36% and 33.64% respectively.

Male children were more as compared to female.

Maximum subject were having age between 12-24 months (40.19%) followed by 6-12 months (25.23%) and >36-59 months (21.5%) respectively.

Pratima K et al[16] in their study too showed that there was male preponderance (67.8% males vs 32.1% females) and majority of the participants (41.2%) were upto or below 6 months of age.

Amol P. Jaybhaye et al[14] in their study found that 38 children were 6-60 months of age, 13 children were 61-120 months of age, and four children were >120 months. Male was the dominating gender. This is in accordance to the present study.

Karen S Leis et al[2] in their study too stated similar age and gender distribution.

Socioeconomic status:

Upper , Upper middle ,lower middle , upper lower and Lower socioeconomic status was were found to be 11.2%, 14.1% , 19.6% , 25.2 % and 29.9 % of the subjects respectively. From the sample set ,maximum number of subjects suffering from acute lower respiratory tract infection was reported more among with lower Socioeconomic status (29.9%).

According to **Karen S Leis et al**[2]; aboriginal ancestry, rural residence, lower socioeconomic status and incomplete immunizations were also associated with an increased risk of ALRI. This is in correspondence to the present study.

Vitamin D and Respiratory Infection:

Vitamin D deficiency and insufficiency was found among 51.4% and 29.9% of the subjects respectively while it was normal in 18.7% of the subjects. Mean vitamin D level was reported to be lowest in very severe pneumonia (8.71ng/ml) followed by severe Pneumonia (25.37ng/ml) and Pneumonia (67.26ng/ml). When mean vitamin D level was compared according to severity of pneumonia, significant difference was found as $p < 0.05$ in this study. with inverse relationship between severity of Pneumonia and Vitamin D level was statistically significant ($p < 0.05$, Pearson correlation coefficient = -0.67)

Pratima K et al[16] in their study revealed that vitamin D deficiency was commoner in cases as compared to controls (80.7 % Vs 25.50%) with OR of 12.40 (95 % CI was 6.13 - 25.38).y. This ratio was highest (74.07%:14.81%) among ‘very severe pneumonia’ subgroup.

It is in concordance with the observations of **Wayse V et al [17]** who enrolled children below 5 yrs of age and reported that Vitamin D levels of < 22.5 nmol/l (severe vitamin D deficiency) was a risk factor for ALRI.

Esposito and Lelii[5] reviewed the literature on vitamin D and respiratory infections and found that vitamin D deficiency is a risk factor for tuberculosis, bronchiolitis, and recurrent otitis media in children. They concluded that maintaining adequate vitamin D levels could be a low-cost and effective method to prevent some respiratory tract infections. Literature from various parts of the world supports the role of vitamin D deficiency in respiratory infections.

However **Akrem Mohammad Atrushi[18]** in their study mentioned that no significant association was found between severe acute respiratory tract infections and serum Vitamin D.

Results :

Table 1: Gender wise distribution among the study subjects

Gender	N	%
Male	71	66.36
Female	36	33.64
Total	107	100

Table 2: Age wise distribution among the study subjects

Age Group (in years)	N	%
6-12 months	27	25.23
12-24 months	43	40.19
24-36 months	14	13.08
>36-59 months	23	21.5
Total	107	100

Table 3: Distribution of subjects according to Socio- Economic Status (according to Modified Kuppuswamy scale)

Socio-Economic status(SES)	N	%
Upper	12	11.2
Upper Middle	15	14.1
Lower Middle	21	19.6
Upper Lower	27	25.2
Lower	32	29.9

Total	107	100
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Table -4 Distribution of subjects according to Socio-Economic status and Vitamin D deficiency

SES	VITAMIN D DEFICIENCY (<20ng/dl)	P value
Upper	2	*<0.01
Upper middle	5	
Lower middle	6	
Upper lower	15	
Lower	27	

Table 5: Distribution of Vitamin D (ng/ml) among the study subjects

Vitamin D (ng/ml)	N	%
Deficiency (<20ng/ml)	55	51.4
Insufficiency(20-30ng/ml)	32	29.9
Normal(>30-80ng/ml)	20	18.7
TOTAL	107	100

Table -6 Distribution of Vitamin D levels in cases according to Severity of Pneumonia

Category of Pneumonia Vitamin D level (ng/ml)	Pneumonia (n = 45)	Severe pneumonia (n = 37)	Very severepneumonia (n = 25)
Deficient	11 (24.4 %)	25 (67.5 %)	19 (76%)
Insufficient	16 (35.5 %)	11 (29.7 %)	5 (20 %)
Normal	18 (40 %)	1 (2.7 %)	1 (4 %)
Total	45	37	25

Table 07: Comparison of level of vitamin D and severity of acute lower respiratory tract infections

Type	Mean Vitamin D (ng/ml)	SD	p value			
			Pearson Correlati on Coeffcie nt	Pneumoni avs Severe pneumonia	PneumoniavsVerySe vere pneumonia	Severe pneumoniavsVerySe vere pneumonia
Pneumo nia	67.26	14.8 9	-0.67	<0.01*	<0.01*	<0.01*
Severe pneumon ia	25.37	11.0 2				
Very severe pneumon ia	8.71	6.58				

Summary and Conclusion:

1. Male was the dominating gender(66.36%)as compared to female in this study.
2. Maximum subjects belong to age between 12-24 months (40.19%) followed by 6-12 months (25.23%).
3. Acute lower respiratory tract infection was reported more among subjects with lower Socioeconomic status (29.9%).
4. Vitamin D deficiency and insufficiency was found among 51.4% and 29.9% of the subjects respectively while it was normal in 18.7% of the subjects.
5. Mean vitamin D level was reported to be lowest in *very severe pneumonia* (8.71ng/ml) followed by *severe pneumonia* (25.37ng/ml) and *Pneumonia* (67.26ng/ml). Using statistical analysis, when mean vitamin D level was compared with severity of pneumonia, inverse relationship was found between them, statistically proven with p value <0.01 Pearson correlation coefficient -0.67

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