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Original Research Article

Association between serum concentration of vitamin D and development of pneumonia

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ABSTRACT

Background: Pneumonia is a common disease with significant morbidity and mortality. There is evidence that vitamin D deficiency can be associated with an increased incidence of lower respiratory illness requiring hospitalization. The objective of this study investigated the impact of vitamin D status on the susceptibility of pneumonia in children the design is Case - Control study, Duration of this study is One year (October 2016 - November 2017) and Setting is Niloufer Hospital, Hyderabad, India. In this study participants are 50 children aged 5 months to 5 years with pneumonia and 50 healthy children of the same age were studied.
Methods: In this case-control study, children aged 5 months to 5 years with pneumonia were compared with healthy children of the same age as the control group. Serum levels of vitamin D in both groups were measured by chemiluminescence method. Mean serum levels of vitamin D in patients with pneumonia and control groups were compared using t test.
Results: The mean serum levels of vitamin D in the group with pneumonia and the control group were 25.98±14.8 ng/mL and 31.18±15.81 ng/mL, respectively. The difference between the two groups was significant. However, this difference was more significant in the age group of 24 to 60 months.
Conclusions: According to findings, a low level of Vitamin D is associated with a higher incidence of pneumonia and more severe disease. It is recommended to pay more attention to vitamin D deficiency in infectious diseases, particularly in pneumonia patients.

Keywords: Children, Pneumonia, Vitamin D deficiency

INTRODUCTION

Lower respiratory tract infections are among the most important causes of morbidity and mortality in the childhood, approximately two million children aged below five years die each year because of pneumonia.[1] Pneumonia is an inflammatory condition of the lung affecting primarily the small air sacs known as alveoli. Typically, symptoms include some combination of productive or dry cough, chest pain, fever, and trouble breathing. Most cases of pneumonia are caused by microorganisms, but some noninfectious causes including aspiration of food or gastric foreign bodies, hydrocarbons, and hypersensitivity reactions to drugs or radiation-induced pneumonitis are also involved.[2] Pneumonia and its causes are difficult to prove because lung tissue (biopsy) culture is an aggressive procedure and is rarely done. Vitamin D is a group of fat-soluble secosteroids responsible for increasing intestinal absorption of calcium, magnesium, and phosphate, and

multiple other biological effects.[3] In humans, the most important compounds in this group are vitamin D3 (also known as cholecalciferol) and vitamin D2 (ergocalciferol).

Cholecalciferol and ergocalciferol can be ingested from the diet and from supplements. Only a few foods contain vitamin D.[4,5] The major natural source of the vitamin is synthesis of cholecalciferol in the skin from cholesterol through a chemical reaction that is dependent on sun exposure (specifically UVB radiation). Dietary recommendations typically assume that all of a person's vitamin D is taken by mouth, as sun exposure in the population is variable and recommendations about the amount of sun exposure that is safe are uncertain in view of the skin cancer risk.[6] There is growing evidence that vitamin D plays an important role in immune regulation in the human body by modulating both innate and adaptive immunity as well as regulating the inflammatory cascade. Recently, numerous studies have suggested that vitamin D plays a role in various infectious processes at different ages.[7,8]

A common example of the relationship between vitamin D insufficiency and the susceptibility to infectious disease was found to be tuberculosis. Previous studies have shown that pneumonia and sepsis are linked to vitamin D insufficiency.[9-10] This study investigated the impact of vitamin D status on the susceptibility and severity of pneumonia in children.

METHODS

The Place of Study is Niloufer Hospital, Hyderabad India. Type of Study is Case - Control Study and Sample Collection is Serum 25 (OH)D levels were detected and estimated by chemiluminescence using a Fluoroskan (DiaSorin LIAISON, Stillwater, MN) with micro-whole blood, which recently received a Federal Drug Administration clearance letter (510K). Level of 32 nanograms per milliliter (80 nmol per liter) or more was considered normal and less as vitamin D deficient.

Sampling methods

The total sample size was calculated using the following formula and 50 cases were determined in each group.

Number of Samples in Each Age Group

$$n = \frac{\left(z_{1-\frac{\alpha}{2}} + z_{1-\beta}\right)^2 \left(\delta_1^2 - \delta_1^2\right)}{\left(\mu_1 - \mu_2\right)^2}$$

Inclusion criteria

Children aged 5 months to 5 years with pneumonia.

Exclusion criteria

Children with underlying disease, history of asthma, history of chronic cardiopulmonary disease, gastroesophageal reflux disease, and rickets were excluded.

Statistical methods

Mean serum levels of vitamin D in patients with pneumonia and control groups were compared using t test.

RESULTS

In this study, 50 children with pneumonia aged 5 months to 5 years (23 males and 27 females) and 40 controls as the control group in the same age range (30 males and20 females) were enrolled in this study. As shown in Table 1 there was no statistical significance in sex and age variables (P value >0.05 for both the variables).

Table 1: Demographic characteristics of the study populations.

Characteristics	Group	Cases	Controls	Total	p value
Sex	Boys	23 (46%)	30 (60%)	53 (53%)	0.633
	Girls	27 (54%)	20 (40%)	47 (47%)	
Total		50 (100%)		100 (100%)	
Age (months)	5-23	38 (12%)	20 (40%)	58 (58%)	0.061
	24-60	12 (24%)	30 (60%)	42 (42%)	
Total		50 (100%)	50 (100%)	100 (100%)	

Table 2: Mean serum vitamin D levels.

	Mean serum vitamin D levels	
	5-23 Months	**24-60 Months**
Cases	30.19±15.6 ng/ml	14.15±5.33 ng/ml
Controls	37.96±16.1 ng/ml	21.88±8.81 ng/ml

The mean serum levels of vitamin D in the group with pneumonia and the control group were 25.98±14.8 ng/mL and 31.18±15.81 ng/mL, respectively. In the 5 to 23 months age group, the mean serum level of vitamin D in the group with pneumonia was lower than the control group. As depicted in Table 2, in 24 to 60 months age group, the mean serum level of vitamin D in the group with pneumonia was significantly lower than the control group.

DISCUSSION

Pneumonia is a common disease with significant morbidity and mortality. There is evidence that vitamin D deficiency can be associated with an increased incidence of lower respiratory illness requiring hospitalization.[12,13] This study investigated the impact of vitamin D status on the susceptibility of pneumonia in children. The mean serum levels of vitamin D in the group with pneumonia and the control group were 25.98±14.8 ng/mL and 31.18±15.81 ng/mL, respectively. Similar study by Oduwole et al, have reported that the mean serum level of vitamin D in children with pneumonia was lower than that of the control group.[14]

At age 5 to 23 months, the mean serum level of vitamin D in the group with pneumonia was lower than the control group. Roth et al, in a study conducted in Bangladesh reported that serum levels of vitamin D in children aged 1 to 18 months with pneumonia were significantly lower than that of the control group.[15] The difference between the results of these studies may be due to vitamin D supplementation provided to infants younger than 24 months that makes vitamin D levels in this age group higher than the 24 to 60 months age group. In this study, the mean serum level of vitamin D in patients with pneumonia aged 24 to 60 months was lower than that of the control group, and this difference was statistically significant. It seems that in this age group, vitamin D deficiency is associated with a greater incidence of pneumonia.

Alabama et al, in a study in Egypt found that serum level of vitamin D in children aged 2 to 5 years with pneumonia was lower than that of the control group.[16] Serum levels of vitamin D of patients with pneumonia and the control group children aged 24 to 60 months were lower than those aged 5 to 23 months. The reason for this stance may be Indian National Program for prophylactic administration of vitamin D that focuses on children less than 2 years. In these studies, the mean serum level of vitamin D in children with pneumonia, both females and males, was not significantly different from that of the control group.

CONCLUSION

According to findings, a low level of Vitamin D is associated with a higher incidence of pneumonia and more severe disease. It is recommended to pay more attention to vitamin D deficiency in infectious diseases, particularly in pneumonia patients.

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REFERENCES

1. Bryce J, Boschi-Pinto C, Shibuya K, Black RE. WHO estimates of the causes of death in children. Lancet. 2005;365(9465):1147-52.
2. Rudan I, Boschi-Pinto C, Biloglav Z, Mulholland K, Campbell H. Epidemiology and etiology of childhood pneumonia. Bulletin of the World Health Organization. 2008;86(5):408-16.
3. Das RR, Singh M, Shafiq N. Short term therapeutic role of zinc in children LTHEXA5 year age hospitalised for severe acute lower respiratory tract infection. Paediatric Respiratory Reviews. 2012;13:184-91.
4. Chang AB, Torzillo PJ, Boyce NC, White AV, Stewart PM, Wheaton GR, et al. Zinc and vitamin A supplementation in indigenous Australian children hospitalized with lower respiratory tract infection: a randomised controlled trial. Med J Aust. 2006;184(3):107-12.
5. Raloff J. The antibiotic vitamin: deficiency in vitamin D may predispose people to infection. Science News. 2006;170(20):312-7.
6. Liu PT, Stenger S, Li H, Wenzel L, Tan BH, Krutzik SR, et al. Toll-like receptor triggering of a vitamin D-mediated human antimicrobial response. Science. 2006;311(5768):1770-3.
7. White JH. Vitamin D signaling, infectious diseases, and regulation of innate immunity. Infect Immun. 2008;76(9):3837-43.
8. Gombart AF, Borregaard N, Koeffler HP. Human cathelicidin antimicrobial peptide (CAMP) gene is a direct target of the vitamin D receptor and is strongly up-regulated in myeloid cells by 1,25-dihydroxyvitamin D3. FASEB J. 2005;19(9):1067-77.
9. Holick MF. Sunlight “D” ilemma: risk of skin cancer or bone disease and muscle weakness. Lancet. 2001;357:4-6.
10. Fawzi WW, Mbise RL, Fataki MR, et al. Vitamin A supplementation and severity of pneumonia in children admitted to the hospital in Dar es Salaam, Tanzania. Am J Clin Nutr. 1998;68(1):187-92.
11. Hemilä H, Louhiala P. Vitamin C may affect lung infections. J R Soc Med. 2007;100(11):495-8.
12. Watkins RR, Lemonovich TL, Salata RA. An update on the association of vitamin D deficiency with common infectious diseases. Can J Physiol Pharmacol. 2015;93(5):363-8.
13. Youssef DA, Ranasinghe T, Grant WB, Peiris AN. Vitamin D’s potential to reduce the risk of hospital

acquired infections. Dermatoendocrinol. 2012;4(2):167-75.
14. Oduwole AO, Renner JK, Disu E, Ibitoye E, Emokpae E. Relationship between vitamin D levels and outcome of pneumonia in children. West Afr J Med. 2010;29(6):373-8.
15. Roth DE, Shah R, Black RE, Baqui AH. Vitamin D status and acute lower respiratory infection in early childhood in Sylhet, Bangladesh. Acta Paediatr. 2010;99(3):389-93.
16. Albanna EAM, Ali YF, Elkashnia RAM. Vitamin D and LL-37 in children with pneumonia. Egypt J Pediatr Allergy Immunol. 2010;8(2).

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