International Journal of Contemporary Pediatrics
Ahmed N et al. Int J Contemp Pediatr. 2016 Nov;3(4):1419-1421
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20163690

Original Research Article

A study of association between vitamin d deficiency in sepsis

Nishat Ahmed, Vikram Yadav, Rajendra Kumar Soni, Niranjan Nagaraj*, Pramod Kumar Berwal, Gunshyam Singh Sengar

Department of Pediatrics, S. P. Medical College, Bikaner, Rajasthan, India

Received: 23 August 2016
Accepted: 27 September 2016

***Correspondence:**
Dr. Niranjan N,
E-mail: getniranjan806@yahoo.com

ABSTRACT

Background: Vitamin D is a fat-soluble steroid hormone that contributes to the maintenance of normal calcium homeostasis and skeletal mineralization the aims of this study is to evaluate vitamin D levels in pediatric patients admitted in the intensive care unit with sepsis.
Methods: Fifty children between 1 year to 12 years of age with systemic inflammatory response syndrome (SIRS) with suspected or proven sepsis, admitted in PICU were included for the study. Blood was drawn at the time of admission on the first day of hospital stay for measurement of 25-hydroxyvitamin D (25-OHD) levels.
Results: Forty two (84%) patients out of 50 patients had vitamin D levels < 30ng/ml and only 8 patients had vitamin D >30 ng/ml. This was statistically significant as the p value was <0.05.
Conclusions: Lower 25-OHD levels are associated with sepsis. The multiple functions of vitamin D in the immune system's response to infection suggest it may be an integral component in combating sepsis.

Keywords: Bikaner, Immune system, Sepsis, Vitamin D

INTRODUCTION

Vitamin D is a fat-soluble steroid hormone that contributes to the maintenance of normal calcium homeostasis and skeletal mineralization.[1] Vitamin D also has immunomodulatory effects on immune function.[2] It was suggested that it might have a role in the optimal functioning of the innate immune system by inducing antimicrobial peptides in epithelial cells, neutrophils and macrophages.[2,3]

25-hydroxyvitamin D (25OHD), the primary circulating form, has the ability to induce its own conversion to the active form 1, 25-dihydroxyvitamin D (calcitriol) and produce cathelicidin antimicrobial peptides in the presence of an antigen challenge.[4] Accordingly, low serum 25OHD levels have been linked to increased risk of infection and a recent clinical trial demonstrated that vitamin D supplementation reduced the risk of influenza A infection.[5,6] In addition to infection prevention, vitamin D insufficiency may also be important in the pathogenesis of sepsis, the most fatal consequence of severe infection. In-vitro and animal models of sepsis suggest that vitamin D treatment modulates proinflammatory cytokine production, deranged coagulation, and activation of the vascular endothelium associated with the sepsis syndromes.[7,8] Vitamin D supplementation is a simple intervention that holds the potential to reduce illness severity in patients with infection. However, the association between vitamin D insufficiency and infection severity is not known.

METHODS

This study was conducted in Pediatric intensive care unit (PICU) of Department of Pediatrics, S.P. Medical College and Associated Group of Hospitals, Bikaner (Rajasthan), India. Institutional committee approved our study. The study criteria includes: One year to12 year old

patients admitted to the PICU with proven or suspected sepsis were enrolled in the study and excludes patients with chronic illness like chronic kidney disease, congenital heart disease, cerebral palsy, muscular dystrophy, malabsorption syndrome, nephrotic syndrome, severe acute malnutrition, patients in drugs interfering with calcium metabolism and surgical patients. For measurement of vitamin D, fresh blood sample was taken within 24 hours of admission in PICU and level of vitamin D was measured by VIDAS® 25 OH Vitamin D Total, which is an automated quantitative test for the determination of 25-hydroxyvitamin D Total in human serum or plasma using the ELFA (enzyme linked fluorescent assay) technique. Results were analyzed according to following biological analysis value.

- Deficiency: Below 20 ng/ml
- Insufficiency: 20-30 ng/ml
- Sufficiency: 30-100 ng/ml.

All collected data was tabulated and statically analysed by using SPSS software.

RESULTS

Out of total 50 patients, 16 were females and 34 were males. Forty two (84%) patients out of 50 patients had vitamin D levels < 30 ng/ml and only 8 patients had vitamin D >30 ng/ml. This was statistically significant as the p value was <0.05. In present study, out of total 50 patients 32 patients belonged to rural area and 18 patients belonged to urban area. Out of total 32 rural area patients, 16,8 and 8 belonged to vitamin D3 level <20 ng/mL, 20-29 ng/mL and 30-100 ng/mL respectively while out of total 18 urban area patients, 14, 4 and 0 patients belonged to vitamin D3 level <20 ng/mL, 20-29 ng/mL and 30-100 ng/mL respectively. On applying chi square test, the difference was found statistically significant at vitamin D3 level <20 ng/mL and 30-100 ng/Ml (Table 1).

Table 1: Distribution of cases according to residential area.

Residential area	Vitamin D_3 Level						Total	
	<20 ng/mL (deficiency)		20-29 ng/mL (insufficiency)		30-100 ng/mL (sufficiency)			
	No.	%	No.	%	No.	%	No.	%
Rural	16	53.3	8	66.7	8	100.0	32	64.0
Urban	14	46.7	4	33.3	0	-	18	36.0
Total	30	100	12	100	8	100	50	100
χ^2	3.703		0.048		5.357		6.019	
p	<0.05		>0.05		<0.05		0.049	

Most common diagnosis was LRTI (36%), followed by septicemia (16%), meningitis (16%), acute asthma (6%), acute liver failure, DKA, malaria (4% each), age with severe dehydration, shock, GBS, pertussis encephalopathy, septic arthritis and UTI (2% each). According to outcome, out of total 50 patients, 44 were discharged while 5 patients were expired who had their vitamin D3 level < 20 ng/mL (n=4) and 20-29 ng/mL (n=1) and 1 patients was referred to higher center who had his vitamin D3 level 30-100 ng/mL. On applying chi square test, the difference was found insignificant at vitamin D3 level <20 ng/mL and 20-29 ng/mL while significant difference was found at vitamin D3 level 30-100 ng/mL. Mean hospital stay in vitamin D3 levels < 20 ng/mL was 9.13±4.30 days, in vitamin D3 levels 20-29 ng/mL it was 8.58±3.55 days and at vitamin D3 level 30-100 ng/mL mean hospital stay of patients was 8.88±5.22 days. On applying ANOVA test, the difference was found statistically insignificant (p >0.05).

DISCUSSION

This was an observational study. 42 (84%) patients had vitamin D3 levels <30 ng/ml. A study done by Jeng et al in 2009 conducted in adults patients with sepsis and included 70 patients, showed similar observations.[9] They found that all their study subjects with sepsis had vitamin D3 levels < 30 ng/ml. by Ginde et al measured vitamin D levels in 81 adult patients with sepsis and found that 79% patients had vitamin D3 level <30ng/ml.[10] Out of total 50 patients, 32 (64%) were from rural area and 18 (36%) were from urban area. 75% rural and 100% urban patients had their vitamin D3 levels < 30 ng/ml. Bachhel et al studied total 150 patients and found that 81.25% of rural and 94.12% of urban population had their vitamin D3 level < 30 ng/ml.[11]

In our study most common diagnosis was lower respiratory tract infection (36%). Our observations were similar to a study done at St. Vincent hospital, Sydney by Lee et al.[12] They studied total 42 critically ill adult patients and found 15 (36%) patients had respiratory diseases. This was also similar to another study by Azim et al in who studied total 158 patients and found 45 patients (29%) had respiratory diseases.[13] The difference in the duration of hospital stay between patients with sufficient vitamin levels versus insufficient and deficient vitamin D levels was statistically insignificant. Flynn et

al found duration of hospital stay were clinically longer in vitamin D3 deficiency group, although not statistically significant.[14]

5 patients who expired, 4 (80%) patients had deficient vitamin D3 levels and 1 (20%) patient had insufficient vitamin D3 level. No mortality was found among the patients who had sufficient vitamin D3 level. This was similar to a study by Satheesh et al. They studied total 124 patients with sepsis of age group 1 to12 years.[15] In their study 19 (15%) patients were expired. They found out of these 19 patients, 17 (90%) patients had their vitamin D3 levels < 30 ng/ml.

CONCLUSION

The multiple functions of vitamin D in the immune system's response to infection suggest it may be an integral component in combating sepsis. The early clinical data on its role in preventing and attenuating infections has suggested a link but intervention trials have produced mixed results, requiring larger randomized controlled trials to help define the relationship. Furthermore, clinical data also point toward a role of vitamin D and critical illness but a direct relationship with sepsis and its severity and outcomes is yet to be determined by further research.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Luca HF. Overview of general physiologic features and functions of vitamin D. Am J Clin Nutr. 2004;80:1689-96.
2. Clancy N, Onwuneme C, Carroll A, Mccarthy R, Mckenna MJ, Murphy N .Vitamin D and neonatal immune function. J Matern Fetal Neonatal Med. 2013;26:639-46.
3. Kempker JA, Han JE, Tangpricha V, Ziegler TR, Martin GS. Vitamin D and sepsis: an emerging relationship. Dermatoendocrinol. 2012;4:101-8.
4. Liu PT, Stenger S, Li H. Toll-like receptor triggering of a vitamin D-mediated human antimicrobial response. Science. 2006;311:1770-3.
5. Ginde AA, Mansbach JM, Camargo CA Jr. Association between serum 25 hydroxyvitamin D level and upper respiratory tract infections in the third national health and nutrition examination survey. Arch Intern Med. 2009;169:384-90.
6. Urashima M, Segawa T, Okazaki M, Kurihara M, Wada Y, Ida H. Randomized trial of vitamin D supplementation to prevent seasonal influenza A in school children. Am J Clin Nutr. 2010;91:1255-60.
7. Equils O, Naiki Y, Shapiro AM. 1, 25-Dihydroxyvitamin D3 inhibits lipopolysaccharide induced immune activation of human endothelial cells. Clin Exp Immunol. 2006;143:58-64.
8. Møller S, Laigaard F, Olgaard K, Hemmingsen C. Effect of 1,25-dihydroxy-vitamin D3 in experimental sepsis. Int J Med Sci. 2007;4:190-5.
9. Jeng L, Yamshchikov AV, Judd SE, Blumberg HM, Martin GS. Alterations in vitamin D status and anti-microbial peptide levels in patients in the intensive care unit with sepsis. J Transl Med. 2009;7:28.
10. Ginde AA, Camargo CA, Shapiro NI. Vitamin D insufficiency and sepsis severity in emergency department patients with suspected infection. Acad Emerg Med. 2011;18:551-4.
11. Bachhel R, Singh NR, Sidhu JS. Prevalence of vitamin D deficiency in north-west Punjab population: A cross sectional study. Inj J App Basic Med Res. 2015;5:7-11.
12. Lee P, Eisman JA, Center JR. Vitamin D deficiency in critically ill patients. N Engl J Med. 2009;360:1912-4.
13. Azim A, Ahmed A, Yadav S, Baronia AK, Gurjar M et al. Prevalence of vitamin D deficiency in critically ill patients and its influence on outcome: experience from a tertiary care centre in North India (an observational study). J Intensive Care. 2003;1(1):14.
14. Flynn L, Zimmerman LH, Mcnorton K, Dolman M, Tyburski J, Baylor A, et al. Effects of vitamin D deficiency in critically ill surgical patients. Am J Surg. 2012;203:379-82.
15. Satheesh P, Verma S, Singhi S, Bansal A. Prevalence of vitamin D deficiency among children with sepsis, its assocaiton with sepsis severity and its outcome in a pediatric IUC. Critical Care. 2013;17(4):35.

Cite this article as: Ahmed N, Yadav V, Soni RK, Nagaraj N, Berwal PK, Sengar GS. A study of association between vitamin d deficiency in sepsis. Int J Contemp Pediatr 2016;3:1419-21.