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TO STUDY CORRELATION OF SERUM VITAMIN D LEVEL WITH OSTEOARTICULAR INFECTION

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Abstract

Background: To study correlation of serum vitamin D level with osteoarticular infection

Methods: All patients (5 to 65 years of age) were presented with pain and raised local temperature of osteoarticular joint or prosthetic joint in the Orthopaedic department of S.M.S. Medical college and attached hospitals, were included in the study.

Results: The mean (SD) of S. Vitamin D (ng/mL) in the Osteoarticular Infection: Present group was 19.08 (8.41). The mean (SD) of S. Vitamin D (ng/mL) in the Osteoarticular Infection: Absent group was 18.53 (9.26). The median (IQR) of S. Vitamin D (ng/mL) in the Osteoarticular Infection: Present group was 17.7 (14.15-23.3). The median (IQR) of S. Vitamin D (ng/mL) in the Osteoarticular Infection: Absent group was 14.85 (11.6-23.3). The S. Vitamin D (ng/mL) in the Osteoarticular Infection: Present ranged from 8.2 -38. The S. Vitamin D (ng/mL) in the Osteoarticular Infection: Absent ranged from 9.2 - 46.

Conclusion: Our study result were similar in respect to other authors but statistically not significant, therefore requires reopening of the debate on correlation of serum vitamin D with osteoarticular infections.

Keywords: Osteoarticular Infection, Vitamin D, Joint

Introduction

Classical actions of vitamin D, such as promotion of calcium homeostasis and bone health are well known, and several studies suggest that it also regulates innate and adaptive immune function, including activation and differentiation of macrophages, dendritic cells and lymphocytes [1]. Vitamin D3 is produced in the skin from 7-dehydrocholesterol in a dual-stage where the B ring is broken under ultraviolet rays, and the pre vitamin 3 formed in this process isomerises to D3 in a thermosensitive but non catalytic process[1].

The three main phases in vitamin D metabolism, 25-hydroxylation, 1 alpha-hydroxylation, and 24-hydroxylation, are all phases done by cytochrome P450 oxidases. In the first phase, vitamin D converts into 25 hydroxy-vitamin D. In addition, small amounts of vitamin D, either in form of vitamin D2 or vitamin D3, can enter the body from dietary intake and convert into active form by hydroxlyation. The next step toward full activation is conversion into 1,25 dihydroxy- vitamin D by 1-alpha hydroxylase enzyme. It is a mitochondrial enzyme and present in the proximal renal tubules of the kidney. 25-Hydroxy-vitamin D 24 hydroxylase can hydroxylate both 25 hydroxy-vitamin D and 1,25 dihydroxy-vitamin D. In addition to 1,25 dihydroxy- vitamin D, the kidney also produces 24,25 dihydroxy-vitamin D, and that is inactive metabolite[2].

There are many other roles of vitamin D found in human body other than its classical actions on calcium metabolism and musculoskeletal system health. Most of the body tissues have receptors for, 1,25 dihydroxy-vitamin D, which act as a active form of vitamin D and they are known as vitamin D receptors. Additionally, most of these tissues also contain the enzyme 1 alpha-hydroxylase, which is responsible for the conversion of the major circulating form of vitamin D, 25-hydroxy-vitamin D, to its active metabolite 1,25 dihydroxy-vitamin D. Regulation of conversion 25-hydroxy-vitamin D, to its active metabolite 1,25 dihydroxy-vitamin D at the tissue level is different from the conventional activation that occurs in the kidney and it is more susceptible to vitamin D deficiency because it is more dependent on substrate[2-3].

Materials and Methods

Study location: Department of Orthopaedics in teaching hospitals attached to S.M.S Medical College and attached hospitals.

Study design: Observational Cross sectional

Sample size: Minimum 50 cases

Study population:

All patients (5 to 65 years of age) were presented with pain and raised local temperature of osteoarticular joint or prosthetic joint in the Orthopaedic department of S.M.S. Medical college and attached hospitals, were included in the study. Patients meeting the inclusion criteria was subjected to clinical examination, radiological examination blood investigations.

Inclusion Criteria:

1) Patients between 5 to 65 years of age.

2) Clinical and pathological diagnosed case of osteoarticular infection

Exclusion Criteria:

1) Receiving calcium and vitamin D supplements
2) Osteomalacia
3) Autoimmune diseases
4) Chronic kidney disease
5) Chronic liver disease
6) Serious cardiopulmonary disease

Statistical Analysis

The data were entered in MS EXCEL spreadsheet and analysis was done using Statistical Package for Social Sciences (SPSS) version 21. Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean ± sd and median. Normality of data tested by Kolmogorov-Smirnov test. If the normality was rejected then non parametric test has been used. A p-value of <0.05 was considered statistically significant.

Result

Table 1: Comparison of the 2 Subgroups of the Variable Osteoarticular Infection in Terms of S. Vitamin D (ng/mL) (n = 50)

S. Vitamin D (ng/mL)	Osteoarticular Infection		t-test	
	Present(A+C)	Absent(B+D)	t	p value
Mean (SD)	19.08 (8.41)	18.53 (9.26)	0.48	0.84
Median (IQR)	17.7 (14.15-23.3)	14.85 (11.6-23.3)		
Range	8.2 – 38	9.2 – 46		

The variable S. Vitamin D (ng/mL) was normally distributed in the 2 subgroups of the variable Osteoarticular Infection. Thus, parametric tests (t-test) were used to make group comparisons.

The mean (SD) of S. Vitamin D (ng/mL) in the Osteoarticular Infection: Present group was 19.08 (8.41). The mean (SD) of S. Vitamin D (ng/mL) in the Osteoarticular Infection: Absent group was 18.53 (9.26). The median (IQR) of S. Vitamin D (ng/mL) in the Osteoarticular Infection: Present group was 17.7 (14.15-23.3). The median (IQR) of S. Vitamin D (ng/mL) in the Osteoarticular Infection: Absent group was 14.85 (11.6-23.3). The S. Vitamin D (ng/mL) in the Osteoarticular Infection: Present ranged from 8.2 -38. The S. Vitamin D (ng/mL) in the Osteoarticular Infection: Absent ranged from 9.2 - 46.

There was no significant difference between the groups in terms of S. Vitamin D (ng/mL) (t = 0.48, p = 0.84)

Table 2: Association Between Osteoarticular Infection and S. Vitamin D (n = 50)

S. Vitamin D	Osteoarticular Infection			Chi square test	
	Present (A+C)	Absent (C+D)	Total	X^2	P Value
Deficient(<20)	21 (70.0%)	13 (65.0%)	34 (68.0%)	0.18	0.91
Insufficient(20-29)	6 (20.0%)	5 (25.0%)	11 (22.0%)		
Sufficient (30-100)	3 (10%)	2 (10.0%)	5 (10.0%)		
Total	30 (100.0%)	20 (100.0%)	50 (100.0%)		

S. Vitamin D	Adjusted P Values
Deficient vs. Insufficient	0.06
Deficient vs. Sufficient	0.43
Insufficient vs. Sufficient	0.7

Chi square test was used to explore the association between 'Osteoarticular Infection' and 'S. Vitamin D'.
There was no significant difference between the various groups in terms of distribution of S. Vitamin D (X^2 = 0.18, p = 0.91).

70.0% of the participants in the group [Osteoarticular Infection: Present] had [S. Vitamin D: Deficient]. 20.0of the participants in the group [Osteoarticular Infection: Present] had [S. Vitamin D: Insufficient]. 10.0% of the participants in the group [Osteoarticular Infection: Present] had [S. Vitamin D: Sufficient]. 65.0% of the participants in the group [Osteoarticular Infection: Absent] had [S. Vitamin D: Deficient]. 25.0% of the participants in the group [Osteoarticular Infection: Absent] had [S. Vitamin D: Insufficient]. 10.0% of the participants in the group [Osteoarticular Infection: Absent] had [S. Vitamin D: Sufficient].

Discussion

Vitamin D metabolism is complex but well known and researched. Today, we know that its homeostasis depends not only on adequate nutritional intake but also on intact kidney and liver function as well as sufficient exposure to sunlight. Previous studies have linked vitamin D with several other immunological alterations that are associated with increased susceptibility to infection. Active vitamin D stimulates phagocytosis and killing of bacteria by macrophages. It suppresses T-cell proliferation and attenuates the production of T-helper type 1 cytokines while promoting the production of T-helper type 2 cytokines. T-helper type 2 cells primarily play a role in response to extracellular pathogens, such as most bacteria and parasites that cause periprosthetic joint infection. Staphylococcus aureus and Streptococcus epidermidis, mainly gram-positive bacteria predominate in cases of joint prosthesis contamination, but infections are also caused by Gram-positive bacilli and fungi. Studies have proved that vitamin D has a negative effect on the growth of Staphylococcus aureus, Streptococcus pyogenes, Klebsiella pneumoniae and Escherichia coli, and other bacteria. In the presence of vitamin D3, such organisms were either killed or demonstrated marked growth inhibition. Gram-positive bacteria, invasive pneumococcal disease, meningococcal disease and group A streptococcal disease are more common when vitamin D levels are low, raising the possibility that pharmacological doses of vitamin D may be an effective adjuvant therapy. Vitamin D acts by inducing antimicrobial peptide gene expression and regulates the immunological response to intracellular pathogens. However, its importance in infections of the musculoskeletal health system is insufficiently evaluated, although a widespread prevalence of vitamin D deficiency is known in orthopedic patients. So, there is a lack of analyses, especially according to osteoarticular infections. The present study was focused on patients with osteoarticular infection and their serum vitamin D status which was related to the eventual presence of a prosthetic failure and/or an infective pathology. We decided to determine serum 25 hydroxy- vitamin D instead of its active form 1,25 dihydroxy-vitamin D because the 25 hydroxy-vitamin D is recommended for determination of vitamin D status, it has longer half-life, and is used because of the fact that it is the most abundant circulating metabolite and the most reliable indicator of vitamin D intake and storage. We recorded a prevalence of 25hydroxy-vitamin D deficiency in 34 (68.0%) of the participants (S. Vitamin D: Deficient), 11 (22.0%) of the participants had low 25hydroxy-vitamin D (S. Vitamin D: Insufficient), 5 (10.0%) of the participants had adequate 25hydroxy-vitamin D (S. Vitamin D: Sufficient).

The mean (SD) of S. Vitamin D (ng/mL) in the Osteoarticular Infection: Present group was 19.08 (8.41). The mean (SD) of S. Vitamin D (ng/mL) in the Osteoarticular Infection: Absent group was 18.53 (9.26). The median (IQR) of S. Vitamin D (ng/mL) in the Osteoarticular Infection:present group was 17.7 (14.15-23.3). The median (IQR) of S. Vitamin D (ng/mL) in the Osteoarticular Infection: Absent group was 14.85 (11.6-23.3). The S. Vitamin D (ng/mL) in the Osteoarticular Infection: Present ranged from 8.2 - 38. The S. Vitamin D (ng/mL) in the Osteoarticular Infection: Absent ranged from 9.2 - 46. There was no significant difference between the osteoarticular infection group and non infectious group in terms of S. Vitamin D (ng/mL) (t = 0.48, p = 0.84).

In our study, the mean serum vitamin D level between the two groups was more or less the same but no statistically significant association was found.

In a study from 2013 Tiwari et al. [4] showed a high prevalence of vitamin D deficiency in patients with diabetic foot infection: 125 patients with diabetic foot infection were compared with diabetic patients without infection, vitamin D deficiency was prevalent and severe in patients with diabetic foot infection. The authors raised the issue of recognition of severe vitamin D deficiency as a possible risk factor for diabetic foot infection whereas the most fatal consequence of infection is sepsis. In a pilot study to evaluate the association between vitamin D status and sepsis severity, vitamin D insufficiency was consistently associated with severe sepsis. The authors suggested that vitamin D supplementation, particularly in higher-risk populations, holds the potential to lower the risk of incident infection and associated morbidity, such as sepsis. In addition to prevention, vitamin D has the potential to modulate inflammatory and coagulation-induced sepsis syndromes.

In a study was published by Maier et al [5] in 2014. They found an association between an extremely low vitamin D level and periprosthetic joint infections. The authors concluded that vitamin D supplementation could be a

safe and easy way to reduce the risk of periprosthetic joint infection.

Conclusion

Our study result were similar in respect to other authors but statistically not significant, therefore requires reopening of the debate on correlation of serum vitamin D with osteoarticular infections.

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