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ORIGINAL RESEARCH ARTICLE

The Present Study Examined the Correlation of Vitamin D Level with Disease Activity in Rheumatoid Arthritis: Cross-sectional Study

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ABSTRACT

Introduction: Serum vitamin D levels are much decreased in RA patients. A person >39 vulnerability to RA and RA activity is correlated with their vitamin D level. The aim is to study the correlation of vitamin D levels with disease activity in patients with rheumatoid arthritis.

Materials and Methods: The present study was conducted in the Department of Orthopaedics at SRMS Institute of Medical Sciences, Bareilly, from 1st August 2022 to 31st January 2024 in all the diagnosed patients of rheumatoid arthritis after obtaining approval from an institutional ethics committee.

Results: In 41 to 60 years (46.42%) was the most common age group followed by ≤20 years (14.28%), There was a significant difference in gender between the groups (p = 0.041). Most patients with rheumatoid arthritis have a duration of illness of 1 to 2 years. The correlation between low disease activity and moderate disease activity was significant (p = 0.045) and between low disease activity and high disease activity was significant (p = 0.030), between moderate disease activity and high disease activity was not significant (p = 0.825).

Conclusion: It can be concluded that vitamin D deficiency precipitates disease activity in rheumatoid arthritis patients. Serum vitamin D levels in RA patients typically decline as the disease progresses.

Keywords: Rheumatoid arthritis, Vitamin D.

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INTRODUCTION

Two characteristics of the systemic autoimmune disease RA include extra-articular involvement and inflammatory arthritis. It affects mainly the synovial joints and is an inflammatory chronic condition brought on by a combination of environmental and hereditary causes. It is symmetrical and typically starts in small peripheral joints, and if therapy is not received, it may progress to affect proximal joints.[2-4] Prolonged inflammation of the joints causes cartilage loss and bone erosion, ultimately resulting in joint degeneration. When the symptoms of RA appear for less than six months, it is referred to as early RA, and when they appear for more than six months, it is referred to as established RA.[3] If left untreated, RA progresses and increases in morbidity and mortality.[5]

To help clinicians assess the disease activity of RA patients, a number of clinical assessment methods have been created. The ACR revised its recommendation in 2019 and suggested using the following evaluation methods since they satisfied their minimal evaluation requirements.[6] The easy-to-use DAS28, CDAI, and RAPID3 combination in clinical practice incorporates laboratory tests, provider and patient feedback, and patient input. Vitamin D insufficiency is more common in RA patients, and this may be one of the causes contributing to the onset or exacerbation of RA. Serum vitamin D levels in RA patients typically decline as the disease progresses. To make sure that all RA patients are getting the necessary quantity of vitamin D, a thorough assessment of their vitamin D status is required.[7] Vit-D deficiency is common in RA patients compared to controls, and there is an inverse correlation between the level of Vit-D and RA activity. Serum vitamin D levels are much decreased in RA patients. A person >39 vulnerability to RA and RA activity is correlated with their vitamin D level.[8] The present research aimed to evaluate the correlation of Vit-D level with disease activity in patients of RA.

MATERIAL AND METHODS

The present study was conducted in the Department of Orthopaedics at SRMS Institute of Medical Sciences, Bareilly, from 1st August 2022 to 31st January 2024 in all the diagnosed patients of rheumatoid arthritis after obtaining approval from an Institutional Ethics Committee.

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Inclusion criteria included age >16 and <80 years of age, All the RA patients fulfilling the diagnostic criteria, and Modified American College of Rheumatology criteria.

Exclusion criteria Patients aged <16 and >80 years of age, Those who have SLE, Sjogren syndrome, and any other autoimmune disorder. Patient taking vitamin D supplements within the last 6 weeks. Patient on medication that affects bone and vitamin D metabolism (diuretics, anticonvulsants and thyroxin). Patients having any known diagnosed endocrinal abnormality, patients with known pre-existing morbidity – any renal, cardio, pulmonary complications.

Intervention: Participants were subjected to measure vitamin-D level, ESR CRP and HAQ.

Measures: Disease activity was calculated using the DAS28 score and correlated with vitamin D level.

Data Analysis

ANOVA, chi-square tests, independent t-tests, and regression analysis were employed.

IBM SPSS Statistics trial was used for the statistical analysis. With a wide range of analytical tools, SPSS provided a solid foundation for thorough statistical investigation.

RESULTS

Baseline Characteristics

In this study, in case group, the most common age group was 41 to 60 years (46.42%) followed by ≤20 years (7.14%), 21 to 40 years (25%), and >60 years (21.42%) while in control group, 41 to 60 years (46.42%) was the most common age group followed by ≤20 years (14.28%), 21 to 40 years (32.14%), and >60 years (7.14%). Mean age also showed no significant difference between the groups (p = 0.051). In this study, in the case group, 28.57% of patients were male and 71.43% of patients were female while in a control group, 46.43% of patients were male and 56.57% of patients were female. There was a significant difference in gender between the groups (p = 0.041).

Duration of Illness among Cases

In this study, most patients with rheumatoid arthritis had a duration of illness of 1 to 2 years (57.14%) (Table 3).

Body Mass Index of Patients Enrolled in both Groups

In this study, in the case group the mean BMI of the case group was 25.64 ± 4.79 kg/m^2 and in the control group mean BMI was 23.22 ± 3.19 kg/m^2. There was a significant difference in gender between the groups (p = 0.030).

Blood Investigation of Patients Enrolled in Both Groups

In this study, in the case group mean ESR, mean CRP, mean RA Factor-33.53 ± 28.19, 19.39 ± 25.98, 47.77 ± 32.4, respectively and in the control group mean ESR, mean CRP, mean RA factor-21.35 ± 14.92, 6.65 ± 3.56, <20, respectively and there was a significant difference in CRP (p = 0.0003) and RA factor was positive (mean 47.77 ± 32.4) in the cases and negative (<20 U/mL) in controls.

Vitamin D Levels in Patients Enrolled in Both Cases

Table 1 shows In this study the normal vitamin D level was in 3 cases (mean 35.66 ± 5.65), insufficiency in 3 cases (mean 26 ± 6.36), deficiency in 22 cases (mean 14.22 ± 7.07), in control group, normal in 11 controls (38.63 ± 17.18), insufficiency in 13 controls (25.96 ± 7.07), deficiency in 4 controls (13.75 ± 6.01).

Severity of Disease Activity According to DAS28 Score in Cases

Table 2 shows in this study the cases with low disease activity were 2 (mean DAS28 score 3 ± 0.14), moderate disease activity 20 (mean DAS28 score-3.9 ± 0.53), high disease activity n = 5 (mean DAS28 score-5.32 ± 0.07).

Duration of Illness v/s Vitamin-D Level in Cases

Table 3 shows in this study there was 1 case of vit-D deficiency of < 1-year duration of illness,3 deficient,

Table 1: Body mass index of patients enrolled in both groups

BMI group	*Cases*	*Controls*	*Total*	*p-value*
Underweight (<18.5 kg/m^2)	2 (7.1%)	2 (7.1%)	4 (7.1%)	
Normal (18.5–24.9 kg/m^2)	10 (35.7%)	18 (64.28%)	28 (50%)	
Overweight (25–29.9 kg/m^2)	11 (39.28%)	8 (28.57%)	19 (33.9%)	
Obesity (> = 30 kg/m^2)	5 (17.8%)	0 (0%)	5 (8.9%)	
Total	28	28	56	
Mean BMI	25.64 ± 4.79 kg/m^2	23.22 ± 3.19 kg/m^2		0.030*

Table 2: Blood investigation of patients enrolled in both groups

Blood investigation	*Case (n = 28)*	*Control (n = 28)*	*p-value*
Mean ESR (mm/hr)	33.53 ± 28.19	21.35 ± 14.92	0.048
Mean CRP (mg/L)	19.39 ± 25.98	6.65 ± 3.56	0.0003*
Mean RA factor (U/ml)	47.77 ± 32.4	<20	0.0011*

Table 3: Vitamin D Levels in patients enrolled in both cases

Mean vitamin D levels	*Mean vit-d level in cases*	*No. of cases*	*Mean vit-d level in controls*	*No. of controls*	*p-value*
Normal (>30 ng/dL)	35.66 ± 5.65	3	38.63 ± 17.18	11	
Insufficiency (20–30 ng/dL)	26 ± 6.36	3	25.96 ± 7.07	13	0.0001*
Deficiency (<20 ng/dL)	14.22 ± 7.07	22	13.75 ± 6.01	4	

2 insufficient, 1 normal of 1-year duration of illness, 8 deficient,1 insufficient, 1 normal of 2 year duration of illness. 10 deficient, 0 insufficient 1 normal of >2 year duration of illness

Correlation of Vitamin-D Level with Disease Activity in Cases

Table 4 shows In this study cases (n = 5) with High disease activity have a mean vitamin D level 15.2 ± 7.78, cases (n = 20) with Moderate disease activity have a mean vitamin D level 16.85 ± 17.67, cases (n = 2) with low disease activity has mean vitamin D level 30 ± 14.14 and 1 case of remission with mean vit-d level 10 ± 0.0. The correlation between low disease activity and moderate disease (Tables 5 and 6) activity was significant (p = 0.045) and between low disease activity and high disease activity was significant (p = 0.030), between moderate disease activity and high disease activity was not significant (p = 0.825).

Table 4: Severity of disease activity according to DAS28 score in cases

Severity of disease activity according to DAS28 score (mean)	*Frequency (%)*	*DAS28 score (Mean ± SD)*
Remission (< = 2.6)	1(3.5%)	2.5 ± 0.0
Low disease activity (2.6-3.2)	2(7.1%)	3 ± 0.14
Moderate disease activity (3.2-5.1)	20(71.42%)	3.9 ± 0.53
High disease activity (>5.1)	5(17.85)	5.32 ± 0.07

DISCUSSION

A chronic autoimmune inflammatory illness mostly affecting the synovial joints, RA is associated with severe morbidity and a decreased life expectancy.[9] It is known that both genetic and environmental variables contribute to the pathogenesis of RA, even if the exact cause is still unknown.[10] The expression of genes that influence cellular processes like angiogenesis, apoptosis, differentiation, and proliferation is changed by vit-D (25-hydroxyvitamin D).[20] Vitamin D affects a lot of genes that code for proteins that control cell division, proliferation, and apoptosis. Patients with RA are more likely to have vitamin D deficiency, which may be one of the factors for RA to develop or worsen. Serum vitamin-D levels in RA patients typically decline as the disease progresses.

In case group, the most common age group was 41 to 60 years (46.42%) followed by ≤20 years (7.14%), 21 to 40 years (25%), and >60 years (21.42%) while in control group, 41 to 60 years (46.42%) was the most common age group followed by ≤20 years (14.28%), 21 to 40 years (32.14%), and >60 years (7.14%). There was no significant difference in age group between the groups. In a study by Meena *et al.*, in the RA group, the average patient age was 44.92 ± 13.06 years, while the control group average participant age was 44.02 ± 11.65 years.[7]

There was a significant difference in gender between the groups (p = 0.041). The groups' mean BMIs were not significantly different; the most common duration of illness in the case group was 1 to 2 years (n = 16), followed by >2 years (n = 11), <1-year (n = 1). Most patients with RA have a duration of illness of 1-2 years in our study.

Table 5: duration of illness v/s vitamin-d level in cases

Duration of illness in cases (years)	*No. of cases (Vitamin -D level)*				
	Normal (>30 ng/dL)	*Insufficiency (20–30 ng/dL)*	*Deficiency (<20 ng/dL)*	*Total no of cases*	*Vit-d level (MEAN ± SD)*
<1 year	0	0	1	1 (3.57%)	12 ± 0.0
1 year	1	2	3	6 (21.42%)	22.4 ± 9.96
2 years	1	1	8	10 (35.71%)	14.54 ± 8.54
>2 years	1	0	10	11 (39.28%)	13.10 ± 6.6
total	3	3	22	28	p-value-0.0001*

Table 6: Correlation of vitamin-D level with disease activity in cases

Disease activity	*VIT-D level (ng/dL) (mean ± SD)*	*No. of cases*
Remission	10 ± 0.0	1 (3.57%)
Low disease activity	30 ± 14.14	2 (7.14%)
Moderate disease activity	16.85 ± 17.67	20 (71.42%)
High disease activity	15.2 ± 7.78	5 (17.85%)
p-value	Low disease activity v/s moderate disease activity *p-value* = 0.045**	
	Moderate disease activity vs high disease activity *p-value* = 0.825	
	Low disease activity vs high disease activity *p-value* = 0.030**	

Duration of illness when compared with Vitamin-D level there was 1 case of vit-D deficient of & lt; 1 year duration of illness, 3 deficient, 2 insufficient, 1 normal of 1 year duration of illness, 8 deficient,1 insufficient,1 normal of 2 years duration of illness. 10 deficient, 0 insufficient 1 normal of >2 year duration of illness. As the duration of illness increases there are more cases of deficient vitamin D levels.

Case with LDA were n = 2 (mean DAS28 score3 ± 0.14), MDA n = 20 (mean DAS28 score-3.9 ± 0.53), HDA n = 5 (mean DAS28 score-5.32 ± 0.07). In a study by Meena *et al.*[6] About 12% of the patients fell into the remission category (DAS28 score <2.6), 3% fell into the LDA category (DAS28 score 2.7–3.2), 19% fell into the MDA category (DAS28 score 3.3–5.1), and 22% fell into the HDA category (DAS28 score >5.1). 27 In a study by Mustafa *et al*., 22 (24.4%) of the study subjects had high activity, and 57 (63.3%) had a moderate DAS 28 level.[11]

The vit-D level in case group was normal in 3 cases (mean ± SD-35.66 ± 5.65), insufficient in 3 cases (mean ± SD-26 ± 6.36), deficient in 22 cases (mean ± SD - 14.22 ± 7.07) and (mean ± SD) vit-D level in case group was 17.33 ± 8.6, in control group, (mean ± SD) vit-D level was normal in 11 controls (38.63 ± 17.18), insufficient in 13 controls (25.96 ± 7.07), deficient in 4 controls (13.75 ± 6.01) and (mean ± SD) vit-D level in controls group was 28.42 ± 10.44. There was a significant difference in vitamin D levels in both groups (p = 0.0001).In a study by Meena *et al*., Additionally, compared to the controls (mean value of 32.87 ± 14.16 ng/mL), the serum vitamin D levels in the RA patients were significantly lower (mean value of 21.05 ± 10.02 ng/mL).[7]

In our study cases (n = 5) with HAD has a mean vitamin-D level of 15.2 ± 7.78, cases (n = 20) with moderate disease activity have a mean vitamin-D level 16.85 ± 17.67, cases (n = 2) with low disease activity has mean vitamin-D level 30 ± 14.14 and 1 case of remission with mean vitamin-D level 10 ± 0.0. The comparison between LDA and MDA was significant (p = 0.045) and between LDA and HAD was also significant (p = 0.030) and between MDA and HDA was significant not (p = 0.825). In a study by Attar, In comparison to patients with MDA (35.13+/- 15.2 nmol/L) and LDA (38.05 ± 7.3 nmol/L), patients with HDA had the lowest 25(OH)D levels (18.25 ± 8.3 nmol/L) (p < 0.001). DAS28 and serum Vit-D had a statistically significant negative correlation (r = -0.42, p < 0.0001).[12]

Vit- D deficiency is more common in RA patients than in controls, and there is an inverse correlation between the level of vit- D and the activity of the RA disease. Additionally, the serum vit- D level is quite low in RA patients. Therefore, more research is needed to determine how vit- D supplementation affects the development of the disease in people who are at risk of RA as well as the prevention of disease in those who already have the disease.

CONCLUSION

The study to evaluate the correlation of vitamin D level with disease activity in patients of rheumatoid arthritis. The following conclusion was reached: Vitamin D level correlates inversely with disease activity in rheumatoid arthritis. There were more chances of vitamin-D deficiency with increased duration of illness. Most of the cases with severe disease activity and moderate disease activity had very low vitamin D levels. It can be concluded that vitamin D deficiency precipitates disease activity in rheumatoid arthritis patients. Serum vitamin D levels in RA patients typically decline as the disease progresses.

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