Correlation between Vitamin D and Severity of Periodontitis in CKD patient

Abstract

Introduction:As the disease progresses, chronic kidney disease (CKD) patients become susceptible to a broad range of adverse health outcomes, including periodontitis. Both CKD and periodontitis have been associated with vitamin D deficiency. Vitamin D, known for its role in bone health, also plays a significant role in regulating the immune system, which is why it has been postulated that vitamin D is linked to the severity of periodontitis in CKD patients. This review aims to evaluate the relationship between vitamin D levels and the severity of periodontitis in CKD patients.

Study design: A prospective case control study

Place and duration of study: Department of Medicine SwaroopRani NehruHospital, Prayagraj, India between july 2021 tojune2022

Material and Method:A total of 50 chronic kidney disease patients were included based on inclusion and exclusion criteria. Periodontal evaluation was done and classifies it by using CDC-AAP classification. Cases and controlwere defined after periodontal evaluation. Blood sample was takenfor aninvestigation like serum vitamin D, serum creatinine, and other markers.

Result:Out of 50chronic kidney disease patients, 40ckdpatients(80%) had periodontitis changes considered as CASESand 10(20%)ckd patient did not show any periodontitis changes considered as CONTROL. Cases had lower mean standard deviation (SD) Serum vitamin D levels than controls (13.90±8.16versus25.71 ± 12.68 ηg/mL, $p < 0.002$).MeanSerum Vitamin D of the study population decreased significantly within mild, moderate, and severe periodontitis (p value=0.006).

Conclusion: Therefore, it is evident from our study that serum vitamin D levels were significantly lower in cases as compared to the control.It is also observed that serum vitamin D levels decreaseas the severity of periodontitis increases in patients with chronic kidney disease.

Keywords: chronic kidney disease, periodontitis, stage, severity, serum vitamin D

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1. Introduction

Chronic kidney disease (CKD) is a progressive condition characterized by the gradual loss of kidney function, eventual kidney failure, and the need for renal replacement therapy. CKD patients often experience numerous complications, including an increased risk of periodontitis – a common inflammatory disease affecting the gum and bone around the tooth[1]. Low serum vitamin D levels have been identified as a potential risk factor for both CKD and periodontitis.Vitamin D is a fat-soluble vitamin that plays a crucial role in maintaining bone health and regulating calcium metabolism. Additionally, vitamin D has potent immunomodulatory properties, and its deficiency has been linked to a range of chronic diseases, including those affecting the oral cavity[2,3].Periodontitis is a chronic inflammatory disease of the supporting tissues of teeth, caused by the interaction of bacterial plaque and the host immune response to gingival tissue. CKD patients have a higher risk of periodontitis development, progression, and severity, possibly due to an impaired immune response, decreased healing capacity, or some other complex mechanisms related to the primary kidney disease.Several potential underlying mechanisms explain how vitamin D may modulate periodontitis in CKD patients. One possible factor is related to the immune system, a well-known role of Vitamin D, which may help reduce

inflammation and stimulate tissue healing. Additionally, vitamin D plays a role in maintaining the integrity of connective tissues and promotes bone development and mineralization[4]. Some authors hypothesized that vitamin D may play a role in improving osteoporotic changes of periodontal bone during periodontitis development in CKD patients[5]. A better understanding of the relationship between vitamin D deficiency, CKD, and periodontitis may lead to the development of targeted interventions aimed at improving oral health for CKD patients, improving their quality of life, and reducing the risks of systemic complications.

We postulate that an inadequate level of vitamin D promotes the occurrence of periodontitis in patients with CKD. Therefore, the objective of this study wasto correlatebetween serum vitamin D and periodontitis in CKD patients.

2.Material and Method

2.1 Study design

This is a prospective case-control study that has been approved by the ethics committee of MLN Medical College and Associate Hospitals Prayagraj with registration no. ECR/922/inst./UP/2017 issued under rule 122DD/of the drugs and cosmetics rule 1945.The study was carried out in the Department of Nephrology MLN Medical College Prayagraj India between July 2021 to June 2022. A total of 50 patients suffering from chronic kidney disease participated in this study. The nature of the study was explained to the patients, and written informed consent was obtained from them.The inclusion criteria comprised of all adults (age>18 years), male and female patients.Patients' pre-diagnosed CKD evaluated and recorded.Patientis not on dialysis.Exclusion Criteria comprised ofIndividual who underwent periodontal therapy,malignancy, HIV, hepatitis,upper respiratory tract infections,pregnant And lactating women,Other systemic Infections like AKI andpancreatitis and intake of vitamin d in previous 3 month .

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2.2 Study Procedure

Medical history and clinical examination was taken and recorded theCKD& its stages bymeasuring eGFR and USG abdomen. Laboratory assays of serum BUN, serum creatinine and serum vitamin D were measured. Dental examinations were performed using a Williams-USA probe and a dental mirror, including examination of clinical attachment loss (CAL), pocket probing depth (PD)were measured and recorded. All four aspects of the gums (facial, mesial, distal, and lingual) were evaluated for inflammation. To check the probing depth (PD), a probe was inserted parallel to the longitudinal axis of the teeth and moved around tooth and then the numbers obtained for each tooth are added. The sum was divided by the number of measured areas and to check for the presence or absence of CAL, a probe was inserted into the gingival sulcus and the CEJ distance to the depth of the pocket. By recording the pocket depth and clinical loss of attachment define periodontal disease by using Centers for Disease Control and Prevention (CDC- AAP).

2.3 Statistical analysis

The data was collectedon a semi-structuredquestionnaireand records all tests.Reports were maintained.All observation was made under direct supervisor. Categorical variables were presented in number and percentage (%) and continuous variables were presented as mean and SD. Quantitative variables were compared using Mann Whitney U test /unpaired T Test as appropriate between two groups.Qualitative variables were

comparedusing the chi-square test and Fischer,exact test as appropriate. To measure the strength of association between two scale parameters using Spearman correlation coefficientasappropriate. A P value of< 0.05 was considered statistically significant. The Data was entered in an MS Excel spreadsheet and analysis was done using statistical package for Social Science version 23.0.

Result

A total50 CKD patients included in the study by using inclusion and exclusion criteria

Table 1: Distribution of study population

Groups	Description	Frequency	Percent
Cases	CKD (Chronic Kidney Disease) +Periodontitis	40	80.0
Controls	CKD (Chronic Kidney Disease)	10	20.0
Total		50	100.0

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Table 1 reveals the distribution of study population in which out of 50 CKD patients,40 patients showed periodontitis changes considered as case and 10 patient did not showed periodontitis considered as control. Figure 1 illustrated below shows the percentage of different stages of CKD in cases and control

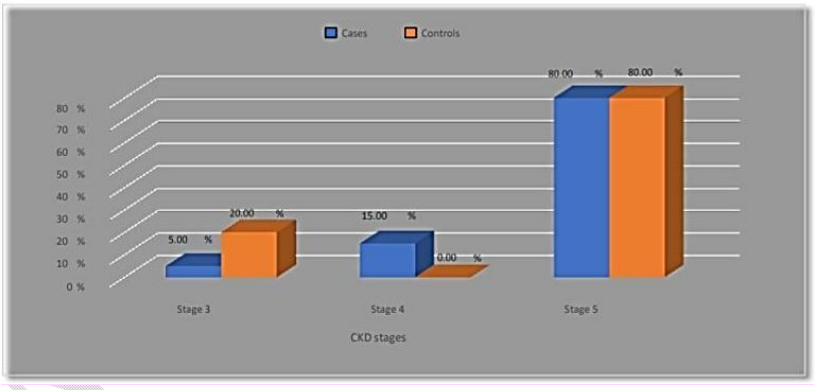

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Fig. 1: Bar graph showing the percentage of different stages of CKD in cases and control.

Figure 1reveals thatincases the percentage of Stage 5, Stage 4 andStage 3 are 80.0%, 15.0% and 5.0%respectively. In controls the percentage ofStage 5, Stage 4 and Stage 3 are 80.0%,00.0% and 20.0% respectively. It showsan insignificant difference between thegroups (p value = 0.153).Table 2 and figure 2 depicted below showing the distribution of CKD stages based on severity of periodontitis in cases.

Table 2: Distribution of CKD stages based on severity of periodontitis in cases

CKD stage	Periodontal status						χ^2 value (df)	p-value
	mild		moderate		severe			
	N	%	N	%	N	%		
stage 3	2	10.5%	0	.0%	0	.0%	5.12 (4)	0.272
stage 4	1	5.3%	2	18.2%	3	30.0%		
stage 5	16	84.2%	9	81.8%	7	70.0%		

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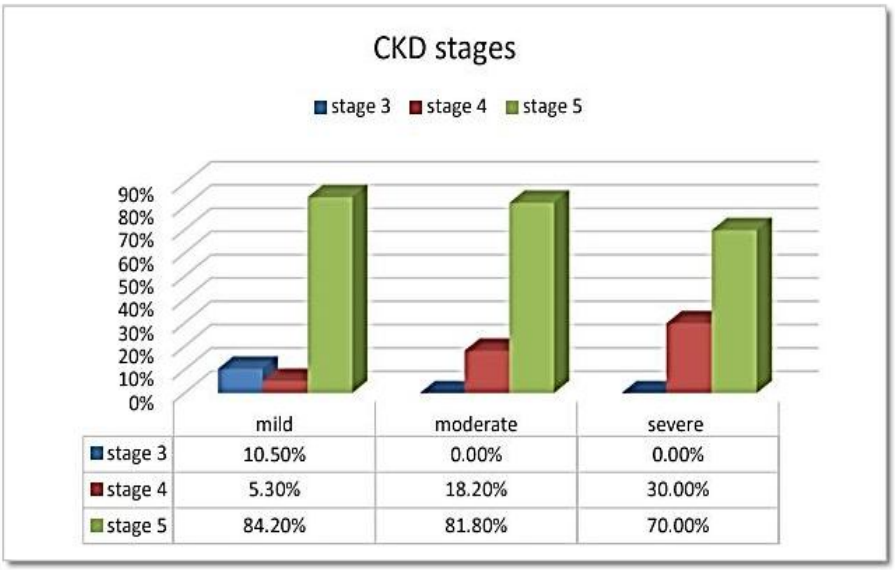

Figure 02: Bar graph showing the percentageof CKD stageswith respect to the severity ofperiodontitis.

Table 2 and figure 2reveals that the CKD stage 5 more associated with periodontitis irrespective of their severity in study population. In mild cases of periodontitis, the percentage of Stage 5, Stage 4, and Stage 3 are 84.2%, 5.3%, and 10.5% respectively. In moderate and severe cases of periodontitis; the percentage of Stage 5 was81.8% and 70.0% respectively.Table 3 given below showing the distribution of serum vitamin d between the cases and control.

Table 3: Distribution of Serum vitamin D between the groups

Marker	Groups			Mann Whitney U test	
Serum Marker	Cases (Mean ±SD)	Control (Mean ±SD)	Total (Mean±SD)	Z value	P value
Vitamin D	13.90±8.16	25.71±12.68	16.26±10.26	-3.094	0.002

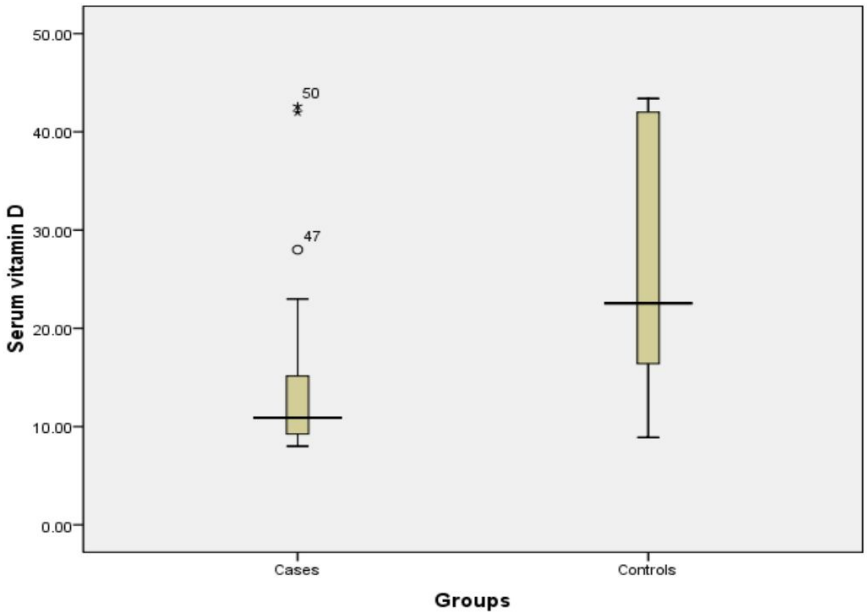

Fig. 3:Box & Whisker diagram showing the mean & standard deviation of Serum vitamin D in cases &control

Serum vitamin D of both groups based on their mean(±SD) is summarized in Table 3. The mean(±SD) serum vitamin D of cases is found to be 13.90±8.16 and controls is 25.71±12.68, the overall mean(±SD) of serum vitamin D is found to be 16.26±10.26. There is a significant difference found in both groups (p value = 0.002). (Fig. 3). Table 4 illustration below showing the relationship between serum vitamin d and severity of periodontitis in CKD patients.

Table 4: Relation between Serum vitamin D and severity of periodontitis

Serum	Periodontal status			ANOVA test	
Marker	Mild (Mean ±SD)	Moderate (Mean ±SD)	Severe (Mean ±SD)	F value	P Value
Serum vitamin D	20.02±11.20	12.12±5.53	9.92±1.55	5.66	0.006

The above table shows that the mean Vitamin D of the study populationdecreases significantly within mild, moderate, and severe periodontitis patients (p value = 0.006).

Discussion

Oral health of CKD patients is often poor due to poor oral hygienebecause of their poor condition. Due to the role of periodontal disease in the development of systemic inflammation and the effectiveness of serum vitamin Dbetween CKD and periodontitis in this regard there are very few literatures with different materials and method in different countries which may not be applicable in our country so we designed this study which is the first from our country.The aim of this study to find out correlation between serumVitamin D and severity ofperiodontitis in CKD patients.The present study included 50patients in which80% of CKD patient showed the periodontitis changes.The findings of this study revealed that the mean(±SD) of Vitamin D of cases were found statistically significant with respect to control (p value=0.002) which was consistent with Bastos et al who studied in smaller size with comparison to our study but serum vitamin d level found to be significant in cases with respect to control p value<0.01.Similarly, Rabienejad et al., (2022) found that the difference in mean serum vitamin D levels between the case and control groups was 33.66, which was statistically significant (P-value <0.001) (Rabienejad et al., 2022) but this study done in dialysis patients and our study specially on pre-dialysispatient.Current study also showed that the serum vitamin D level of the cases decreases significantly as the severity of periodontitis increases.

Conclusion

Therefore our study was evident despite excluding several confounding factors such as smoking, use of Anti-inflammatory medications, recent antibiotic Use, pregnancy, cancer, infection with human immunodeficiency virus, uncompensated diabetes, and fever of unknown origin or other infections, periodontal treatment within the last 6 months, and cases of aggressive or acute periodontal disease.In summary, our findings suggest that vitamin D deficiency predisposes patients with CKD to develop CP, possibly by limiting the patient's inflammatory and immune response against bacterial invasion of the periodontium.A sufficient level of vitamin D is important in maintaining a healthy periodontium and reducing the consequences of periodontitis.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

As per international standard or university standard, patient's consent has been collectedand preserved by the authors.

ETHICAL APPROVAL

Ethical approval was sought and obtained from the Ethics Committee of MLN Medical College, Prayagraj.

Abbreviations

CKD – chronic kidney disease

P- periodontitis

PD – pocket depth

Mild p – mild periodontitis

Moderate p – moderate periodontitis

Severe P – severe periodontitis

CAL- clinical loss of attachment

Serum vit d – Serum vitamin d

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