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Assessment of Periodontal Status in Chronic Kidney Disease Patients

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ABSTRACT

Chronic kidney disease (CKD) has become a worldwide public health concern, with increasing prevalence, high cost, and severe complications. An increased accumulation of supragingival plaque, higher gingival index was found in the patients who underwent hemodialysis (HD). This study was aimed to assess the periodontal status in patients having chronic periodontitis and chronic periodontitis along with CKD stage 5 patients undergoing hemodialysis. This study involved 50 subjects who were grouped as follows, 25 chronic periodontitis patients who were systemically healthy, and 25 chronic periodontitis patients with CKD stage 5 undergoing hemodialysis.

Following clinical parameters was recorded simplified oral hygiene index (OHI-S), Community Periodontal Index (CPI). The results of the OHI-S were interpreted using Shapiro Wilk test and t-test and control group showed a lesser mean value when compared to case group and the results of CPI code 1, 4, X and clinical attachment loss code 0, 1, 4, X showed statistically significant difference between the case and the control group. CKD stage 5 undergoing HD patients had poor oral hygiene and periodontal status in comparison to chronic periodontitis patients who were systemically healthy.

KEYWORDS Chronic kidney disease, End-stage renal disease, Hemodialysis, Chronic periodontitis.

INTRODUCTION

Periodontal diseases are globally prevalent and contribute significantly to oral morbidity and tooth mortality.[1] Periodontitis is a chronic inflammatory disease of infectious origin that leads to destruction of the supporting structures of the teeth, including the periodontal ligament and alveolar bone and, in severe cases, may lead to tooth loss.[2] The main risk factors of periodontal disease are poor oral hygiene, presence of oral plaque microorganisms, genetics, tobacco and alcohol consumption, improper nutrition, stress, and impaired host immune response.[3] Furthermore, they impose a significant infectious and inflammatory burden to the host that results in a state of systemic inflammation.[4] It has

been seen that the systemic diseases like cardiovascular diseases, diabetics, hormonal imbalances like hyperthyroidism,

hypothyroidism, chronic kidney diseases have a major impact on oral health. A reciprocal interrelationship between periodontal diseases and chronic kidney disease (CKD) has also been suggested.[5]

The number of patients with CKD in rapidly developing country was estimated to be 119.5 million,[6] among whom a large majority are or will be suffering from end-stage renal disease (ESRD).[7] CKD has been classified into five types based on the glomerular filtration rate (GFR) which is an indirect measure for assessing the amount of functioning renal tissue and is an important marker for the progressive renal disease; its normal value is in the range of 100–150 mL/min/1.73 m.[8,9] The stages of chronic kidney disease are stage 1 kidney damage with normal or increased GFR (≥90 mL/min/1.73 m^2), stage 2 kidney damage with mild decrease in GFR (60-89 mL/min/1.73 m^2), stage 3 moderate decrease in GFR (30-59 mL/min/1.73 m^2), stage 4 severe decrease in GFR (15-29 mL/min/1.73 m^2) or stage 5 kidney failure (<15 mL/min/1.73 m^2).[9]

In stage 5 kidney failure patients, when kidney function is no longer sufficient to sustain life (typically at a GFR of around 7–8 mL/ min/1.73 m^2),[10] hemodialysis (HD) is a must.[9] Health related quality of life such as physical functioning and role limitation caused by physical problems were found to be reduced in CKD patients in proportion to the severity grade of CKD.[11] It has been estimated that up to 90% of renal patients will show oral symptoms.[12] There are studies which showed the relationship between chronic kidney disease and periodontal disease.[3,6,12.]

This study was aimed to assess the periodontal status in chronic periodontitis patients who were systemically healthy and patients having chronic periodontitis along with CKD stage 5 undergoing HD.

MATERIAL AND METHODS

This case-control study was conducted at S.D.M. College of Dental Science and Hospital and S.D.M. College of Medical Sciences and Hospital, Dharwad, Karnataka. It was approved by the institutional review board. Participants gave their signed informed consent before enrollment.

The inclusion criteria for this study were chronic periodontitis patients who have not undergone any periodontal therapy for past 6 months, patients undergoing HD three times per week for at least 1 year with stable clinical conditions and patients willing to participate in the study. Exclusion criteria were patients aged less than 18 years, psychologic disorder, pregnant women and lactating mothers, patients having any other systemic disease except CKD and smokers. Fifty subjects were selected. The control patients with normal renal function were selected to match the characteristics such as age and sex

of case patients. The case group was comprised of 25 patients with CKD undergoing hemodialysis and control group was comprised of 25 patients with chronic periodontal patients who were systemically healthy.

Medical records were used to collect information on the participant's age, sex, and hemodialysis therapy details. Oral hygiene status was evaluated by using Oral Hygiene Index Simplified (OHI-S), and periodontal status and clinical attachment loss were evaluated using Community Periodontal Index.

Statistical analysis was done by using the Kolmogorov-Smirnov and Shapiro-Wilk test and independent two-sample t test. Categorical variables were compared using frequency table.

RESULTS

As the variables in control and case are normally distributed according to Shapiro Wilk test (Table 1), t test (Table 2) was used which showed a mean of 1.06 with standard deviation of 0.36 for the control group and a mean of 3.02 with standard deviation of 1.20 for the case group which was statistically significant.

Table 1 Tests of normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk*		
	Statistic	Df	Sig.	Statistic	df	Sig.
Control	.16	25	.07	.93	25	.11
Case	.15	25	.11	.95	25	.38
a. Lilliefors Significance Correction						

* $p > 0.05$

Table 2 *t* – test

Group	N	Mean*
Control	25	1.06 ± 0.36
Case	25	3.02 ± 1.20

* $p = 0.000$

The results of Community Periodontal Index (CPI) showed that code 1, 4, X was statistically significant because *p* value was 0.0001, 0.000, 0.009 respectively and other codes had differences in value, but they were not statistically significant. The results of clinical attachment loss (CAL) showed that code 0, 1, 4, X were statistically significant because *p* value was 0.0001, 0.000, 0.046, 0.001 respectively and other codes had differences in value, but they were not statistically significant (Table 3).

Table 3 Community periodontal index

Community periodontal index												
Control							Case					
CODE	1*	2	3	4	X	TOTAL	1	2	3	4	X	TOTAL
FREQUENCY	37	45	46	15	7	150	15	32	33	50	20	150
PERCENT (%)	24.7	30	30	10	4.7	100	10.0	21.3	22	33.3	13.3	100

Clinical attachment loss													
Control								Case					
CODE	0	1	2	3	4	X	TOTAL	0	1	2	3	4	X	TOTAL
FREQUENCY	128	9	4	2	0	7	150	80	4	16	19	11	20	150
PERCENT (%)	85.3	6.0	2.7	1.3	0.0	4.7	100	53.3	2.7	10.7	12.7	7.3	13.3	100

DISCUSSION

There is a bidirectional relation between CKD and periodontal disease. Chronic inflammation related to periodontal infection could promote deterioration of kidney function. Kidney disease patients on renal therapy also present with oral complications due to general state of disability, masking of signs and symptoms by drug therapy.[13]

The results of this study showed a statistically significant difference between the case group and the control group in terms of OHI, CPI and CAL, suggesting that periodontal status of patients undergoing hemodialysis was significantly poorer than that of controls. Borawski J et al. reported that periodontal disease was prevalent and severe in patients with renal failure in terms of different indices, including CPI and CAL.

Indeed, studies have reported poor oral hygiene and high levels of gingival inflammation in renal transplant recipients[14] and in patients undergoing dialysis therapy.[15,16] Poor oral hygiene scores observed in patients having CKD as mentioned in various studies[17,18,19] could be due to malnutrition, anti coagulants and possibly anti platelet agents, immune suppressed patients, stress, xerostomia, gingival hyperplasia. These factors may subsequently lead to neglected oral health. It should also be noted that high inflammatory response could contribute to the aggravated periodontal status in patients with CKD, because C-reactive protein and inflammation increased over time in these patients.[20]

While the increased debris scores among the case group could be due to the condition of the CKD cases as they usually tend to neglect oral health because of their poor systemic health. These changes can be partially attributed to uremia-induced immune dysfunction, characterized by enhanced polymorphonuclear neutrophil[21] and lymphocyte,[22] apoptosis, aberrant monocyte and dendritic-cell function.[23]

It has been proposed that higher salivary urea levels in renal disease patients may be a contributing factor for heavy calculus deposition and thereby increasing calculus index, while the increased debris scores among the case group could be due to the debilitating condition of the CKD cases.[24] Apart from the systemic changes, kidney disease patients on renal therapy also present with oral complications due to disorder of mineral ion homeostasis. And higher levels of phosphorus were observed in the patients with chronic kidney disease along with chronic periodontitis. [6, 25]

According to Loos, the response to periodontal pathogenic bacteria leads to a local tissue-destructive inflammatory response which produces pro-inflammatory immune mediators that can enter the systemic circulation and subsequently exert effects on distant organ systems. Iwasaki M et al., Kshirsagar AV et al., stated that elevated Ig G to periodontal pathogens (*Porphyromonas gingivalis ,Treponema denticola, Aggregatibacter actinomycetemcomitans*) were significantly associated with impaired kidney function- immune modulating effect of chronic renal failure.[26,27]

In this study greater percentage of case group patients exhibited periodontal pockets than the control group. This is in accordance with other studies done by Brito F et al., [28] Zhao D et al., [7] Messier D M et al.[29]

The decline in renal function impairs bone remodeling and quality, but the effect on periodontal bone loss is essentially unknown. Frankenthal et al. reported that average bone loss was similar between the HD group and the control group, suggesting that HD therapy did not have an appreciable effect on radiographic bone height and attributed this to the fact that the patients had different lifestyle, nutrition and oral care. [30] But Messier et al.[29] found a significantly higher extent of bone loss in patients who underwent dialysis.

Treating periodontal disease in CKD patients may need special oral care and is an important factor that might decrease the

systemic inflammatory burden and thereby improve quality of life of these patients.[31]

CONCLUSION

Chronic kidney disease stage 5 undergoing hemodialysis patients had poor oral hygiene and periodontal status in comparison to chronic periodontitis patients who were systemically healthy.

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