Assessment of oral health status and inflammatory markers in end stage chronic kidney disease patients: A cross-sectional study

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ABSTRACT

Aim: To assess the oral health status and inflammatory markers in end stage chronic kidney disease (CKD) patients. **Objectives:** To study and compare oral health status of end stage CKD patients with the control group (matched health individuals) and to study and compare inflammatory biomarkers in study and control groups. **Materials and Methods:** A cross-sectional study was conducted among 50 patients of end stage CKD and 50 matched healthy individual, who were taken as control in the study. Convenience sampling technique was used. Oral health status was recorded by using WHO proforma (2013). Erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) were also measured in the both groups. These are inflammatory markers which show systemic inflammation. Statistical analysis was done by using IBM SPSS Statistics-version 21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) **Results:** The study revealed that patients on dialysis going for transplantation have evidence of increased inflammation as indicated by raised CR*P* values. **Conclusion:** The present study concludes that the oral hygiene of the patients is deteriorated who are having chronic kidney disease. Good oral and dental care in CKD patients can improve the transplant outcomes.

Keywords: Chronic renal failure, dialysis, oral health, oral manifestations, transplantation

Introduction

World Health Organization (WHO) defines oral health as a stage of being free from mouth and facial pain, oral and throat cancer, oral infection and sores, periodontal disease tooth decay, tooth loss and other disease, and disorder that limit an individual's capacity in biting, chewing, smiling, speaking, and psycho social wellbeing.[1]

Oral health and general health are interlinked. The mouth acts as a window to the general health of the body. Bacterial from mouth can cause infection in the other part of the body when the immunity of the host is impaired by disease or medical treatment. Systemic inflammation and treatment also affect the oral health as xerostomia, altered balance of oral microorganisms.

Chronic kidney disease (CKD) is defined as kidney damage for 3 or more months associated with structural or functional

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abnormalities of the kidney with or without decreased dlomerular filtration rate (GFR). CKD is a public health problem with high impact on the quality of life. Modi and Jha carried out a population-based study and found the incidence of end stage kidney disease as 229 per million of population in India.[1]

CKD is a worldwide health problem, with adverse outcome of cardiovascular disease and premature death. It has become evident that inflammation plays an important role in the pathogenesis of arthrosclerosis complication. CKD patient also has an increased risk of arthrosclerosis complication. In line with this, dental problems can be important source of systemic inflammation.

C-reactive protein (CRP) may not be merely a marker of inflammation, but may in fact mediate several key processes in the development of arthrosclerosis including plaque initiation, formation, and rupture.

Study by Menon *et al.* suggested an early involvement of inflammatory process in the development of cardiovascular disease patient with CKD.

CKD patients have associated oral problem arising from the disease process or the effect of therapy or both. Untreated oral lesion may deteriorate the clinical presentation and prognosis.[2] There are clinical and radiological changes in the mouth in CKD patient.[3,4] Some studies have reported higher incidence of oral lesion in dialysis patient with oral symptom of xerostomia, taste disturbance, uremic odour, tongue coating, mucosal inflammation, enamel hypoplasia.[5-7]

Undiagnosed and untreated oral lesion in CKD may result in high graft rejection rate and increase in systemic inflammatory burden.[8] The role of oral infection in worsening the systemic disease is not well established, however, significant improvement in underlying systemic diseases have been observed after treatment of associated oral lesion.[9] Oral health care is important in the management of CKD. In the developed countries, oral health care in CKD patient while in developing countries oral health care is neglected in CKD patients. There is poor dental awareness among the patients and health delivery personnel.

Gingivitis and periodontitis are common manifestation of poor oral health. Poor oral health in CKD patients is an important contributory factor in atherosclerosis, protein energy wasting, systemic infection, and inflammation.

Primary healthcare physician can play a very vital role in early diagnosis of oral health related conditions like dental caries, periodontitis etc., by diagnosing their clinical features like bleeding gums, redness, inflammation, etc., in the patients suffering from chronic kidney disease. Hence, the role of primary healthcare physician, being the first point of contact for general population becomes paramount.

Inflammation play an important role in causing various complications in CKD patient and inflammatory markers such as C-reactive protein, pro and anti-inflammatory cytokines are sensitive and independent predictors of outcomes in CKD patient. Poor oral health could result in stimulation of inflammation and cytokine stimulation. This could result in production of donor specific anti HLA antibodies which could cause rejection. At present oral health evaluation of a prospective kidney transplant recipient before transplantation is not routinely done. There is need to evaluate the benefit of good oral hygiene and its effect on renal transplant outcome.

Material and Methods

The present cross-sectional study was conducted on dialysis patients attending the department of Nephrology at SGPGI hospital, Lucknow. A sample of 50 patients of end stage CKD in the study group and 50 matched individuals in the control group were taken.

Sample size was estimated by using software 'Power Analysis and Sample size' (PASS), version-16 [NCSS, LLC. Kaysville, Utah, USA]. To detect the 30% difference in oral health status between groups, where minimum difference in oral health status (in %) between two groups was assumed to be 70% and 40%, respectively. At minimum two-sided 95% confidence interval and 85% power of the study, the estimated sample size was 48 for each group which was rounded off to a sample of 55 patients. After excluding dropouts, final sample size was 50 patients in each group.

The study protocol was reviewed and approved by the Institutional Ethical Commitee (Dated: 22-02-2018) of Sardar Patel Post Graduate Institute of Dental and Medical Sciences and Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow. The purpose of the study was explained to the participants and written informed consent was obtained in both the languages (English and Hindi).

CKD patients going for renal transplantation were included in the study whereas, CKD patients using artificial denture and patients having infection anywhere in the body were excluded from the study.

The data were collected through a comprehensive WHO Oral Health Assessment Proforma for adults (2013). In addition, ESR and CRP were also measured by the Western green method, latex particle immunoturbidimetric method. A type III clinical examination was carried out as per American Dental Association specification (1970). Patients were examined on ordinary chair under natural day light by a single calibrated examiner using a plain mouth-mirror and CPI probe.

Data were analyzed using IBM SPSS Statistics-version 21 (IBM Corp. Released 2012. IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) Descriptive statistics included calculation of means and standard deviation. Data

distribution was assessed for Normality using Shapiro–Wilk test. Categorical data were compared using chi –square test. All values were considered statistically significant for a value of *P* < 0.05.

Results

Distribution of the demographic and clinical values among the study and control groups are shown. The mean age of the patients was 36.18 ± 11.15 and 35.9 ± 6.64 in group 1 and 2, respectively. The number of decayed teeth were higher in the CKD group and the result were found to be statistically significant (*P* = 0.029). In addition, the bleeding on probing (*P* = 0.011), and pockets with depth of 4–5 mm (*P* = 0.035) were also statistically significant [Table 1].

Distribution of the characteristics among the study and control groups are shown. The gender distribution among the groups was found to be statistically significant (*P* < 0.001). In addition, the fluorosis and erosion scores were also significant among the groups (*P* < 0.001) respectively [Table 2].
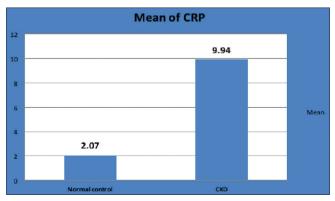
The mean categorical comparison between CKD and control group is shown. The mean value in CKD group was higher amongst the study group (9.94) than the control group (2.07) [Graph 1].

Discussion

The present study was done to assess the oral health status and inflammatory markers in end stage CKD patients. A total of 100 participants were included in the study and were assigned to two groups of 50 patients each. The mean age of patients was 36.18 ± 11.15 and 35.9 ± 6.64 (in years) in group 1 and 2 respectively. However, a similar study conducted by Brito, *et al.* in 2011 had a mean age of 50 years and there was no significant difference found, which is a good indicator as there is no cofounding effect of the age on the true difference when observed in the clinical variable between the groups.[10]

In the present study conducted, the number of teeth involved was observed in different clinical variable and compared between CKD group and control group. The number of decayed teeth were higher in the CKD group and the result were found to be statistically significant (*P* = 0.029). Similar results were found in the study conducted by Brito *et al.*, 2011. In addition, the present study conducted and study done by Brito *et al.*, 2011 revealed that bleeding on probing and the percentage sites with clinical attachment loss of 0–3 mm and 4–5 mm, pocket depth of 4–5 mm were found to be significantly higher (*P* = 0.009, *P* = 0.001, *P* = 0.035 respectively) amongst chronic kidney disease group.
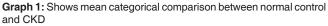
Table 1: Distribution of the demographic and clinical values among the study and control groups

	CKD (*n*=50) Mean±SD	Control (*n*=50) Mean±SD	*P***
*Age	36.18±11.15	35.90±6.64	0.879
D (Decayed)	0.0 (0.0-2.0)	2.0 (0.0-3.0)	**0.029***
M (Missing)	0.0(0.0-1.0)	0.0 (0.0-1.0)	**0.047***
F (Filled)	0.0 (0.0-1.3)	0.0 (0.0-0.3)	0.781
DMF	2.0 (0.0-3.0)	3.0 (2.0-4.0)	**0.015***
Bleeding	0.0 (0.0-0.5)	0.0 (0.0-0.0)	**0.011***
Pocket: 4-5 mm	0.0 (0.0-4.25)	0.0 (0.0-0.0)	**0.035**
Pocket : ≥6 mm	0.0 (0.0-0.0)	0.0 (0.0-0.0)	**0.042***
Loss of Attachment: 0-3 mm	6.0 (5.0-6.0)	6.0 (6.0-6.0)	**0.010***
Loss of Attachment: 4-5 mm	0.0 (0.0-1.0)	0.0 (0.0-0.0)	**0.018***
Loss of Attachment: ≥6 mm	0.0 (0.0-0.0)	0.0 (0.0-0.0)	0.080

*P<0.05 significant, **Chi-Square test

Graph 1: Shows mean categorical comparison between normal control and CKD

Table 2: Distribution of the characteristics among the study and control groups

Variable's		Cases (*n*=50)	Control (*n*=50)	Total (*n*=150)	***P**
Gender	Males	47 (90.4)	5 (9.6)	52 (52.0)	**0.001***
	Females	3 (6.3)	45 (93.8)	48 (48.0)	
Location	Urban	30 (54.5)	25 (45.5)	55 (55.0)	
	Peri Urban	6 (30.0)	14 (70.0)	20 (20.0)	0.134
	Rural	14 (56.0)	11 (44.0)	25 (25.0)	
Fluorosis	Absent	31 (46.3)	36 (53.7)	67 (67.0)	**0.001***
	Present	19 (57.6)	14 (42.4)	33 (33.0)	
Erosion	Absent	30 (44.1)	38 (55.9)	68 (68.0)	**0.001***
	Present	20 (62.5)	12 (37.5)	32 (32.0)	
Oral Mucosal Lesions	0	48 (49.0)	50 (51.0)	98 (98.0)	0.495
	>0	2 (100.0)	0 (0.0)	2 (2.0)	

*P<0.05 significant, **Chi-Square test

As it is clearly evident that chronic renal failure (CRF) is a progressive impairment of the kidney function that is associated with the deterioration of nephrons occurring as a consequence of diabetes, chronic glomerulonephritis and hypertension. In addition, if CRF is not treated, it predisposes to an irreversible stage of disease known as end stage renal disease. It further necessitates to dialysis or kidney transplantation.[11]

Patients having end stage renal disease or CKD are prone to develop pathologic conditions in the oral cavity. A variety of oral signs and symptoms like xerostomia, dental caries, periodontal disease, pockets, dental fluorosis, erosion, and oral mucosal lesions can be seen.[12]

The present study conducted revealed that patients having CKD had significantly higher levels of decayed teeth ($P = 0.029$), bleeding on probing ($P = 0.011$), pockets with depth of 4–5 mm ($P = 0.035$), clinical attachment loss of 0–3 mm, 4–5 mm ($P = 0.010$ and $P = 0.18$. respectively). A similar study conducted by Nylund, *et al.* in 2015 revealed that the prevalence of periodontal disease (pocket depth ≥4 mm) was found higher in CKD patients (88%).[13] Other studies conducted were in accordance with the present study conducted.[14,15]

In the present study, results indicated that there was significant difference in the dental fluorosis and erosion scores ($P = 0.001$) whereas, no significance was found in location and oral mucosal lesion scores ($P = 0.134$, and $P = 0.495$, respectively) among CKD patients group. These results are in accordance with a similar study conducted by Dagirdas *et al.*[15]

As per the literature available, it is clearly evident that in chronic kidney disease patients, the oral health is altered. A similar study was conducted by Bots, *et al.* in 2006 which revealed that patients had significantly more teeth covered with calculus than the control group patients ($P < 0.05$). In addition, the percentage of supra and sub gingival calculus was also found to be slightly higher amongst chronic kidney disease patients (34.4%) than in control group (24.6%).[16,17]

Periodontal disease is believed to be associated with cardiovascular disease which can further lead to systemic atherosclerosis.[18] Intervention studies have shown that the treatment of periodontal disease improves serum inflammatory markers and flow mediated arterial dilation, a marker of endothelial function that becomes dysfunctional early in the cause of atherosclerosis.[19-22]

On reviewing the literature available, it is being found that there is a greater deterioration of oral health and especially periodontal health in patients with chronic kidney disease which needs, quick and immediate attention.[23,24] Our data show that patients on dialysis going for transplantation have evidence of increased inflammation as indicated by raised CRP values. This was accompanied by other objective improvement in oral health indices.

Our study shows that oral disease is quite prevalent in patients with advanced chronic kidney disease going for kidney transplantation. Intervention by a regime of aggressive dental and mouth hygiene would reduce the already existing inflammation and this could have a favorable effect.

Conclusion

The present study concludes that the oral hygiene of the patients is deteriorated who are having chronic kidney disease. Good oral and dental care in CKD patients can improve the transplant outcomes.

It is recommended that all patients on dialysis especially those going for transplantation should undergo dental check-up routinely. They should also be educated to undertake good oral and dental care while on dialysis and follow it up after transplantation.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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