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Original Research Article

SPECTRUM OF ORAL AND DENTAL MANIFESTATIONS IN CHRONIC KIDNEY DISEASE PATIENTS – A SINGLE CENTER EXPERIENCE

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Abstract:

Background:

Increased survival among Chronic Kidney Disease (CKD) patients have led to new problems including concerns for oral health. Periodontitis is a potential proinflammatory state associated with protein energy malnutrition and accelerated atherosclerosis. As supported by literature, patients with periodontitis have higher odds and risks of developing cardiovascular diseases. In our work, we aimed to look into the spectrum of oral and dental manifestations in CKD patients and compare the prevalence of periodontal disease with that of age and gender matched controls.

Study design & population:

This was an observational, case control cross sectional study where 100 patients with CKD and 100 age and sex matched controls were involved. Patients were asked about symptoms of unpleasant taste, dry mouth and burning tongue and were examined for oral lesions such as pale mucosa, dry fissured lips, Saburral tongue, Candidiasis, petechiae, ecchymosis, smooth tongue, ulcerative stomatitis and angular cheilitis by a trained dental surgeon with appropriate armamentarium. The Periodontal disease index using the plaque component, calculus component, gingival and periodontal components were scored for each patient.

Statistical analysis:

Student t-test & Chi-square test were used to determine the difference in clinical parameters between the patients and controls. SPSS version 16.0 was used for data analysis.

Results:

Most common symptoms in CKD patients were xerostomia (45%) and unpleasant taste (42%) while the most common signs were pale mucosa and smooth tongue (28%). Prevalence of uremic fetor, xerostomia, pale mucosa, dry fissured lips, suboral tongue, smooth tongue in diabetic CKD patients was higher than in non-diabetic CKD patients. Periodontal disease index scoring revealed a significantly higher plaque index, calculus index and gingival and periodontal index in CKD patients compared to controls.

Conclusions:
Periodontitis is an ignored source of systemic inflammation in patients with CKD. Our study highlights the rampant prevalence of oral lesions and periodontitis in CKD particularly in diabetic CKD and End stage renal disease (ESRD) patients. Recognising and managing periodontitis at an early stage may help in decreasing the pro inflammatory state and increasing the nutritional status of CKD patients. Periodic oral cavity and periodontal assessment should be made a part of routine standard of care in CKD patients.

Keywords: Oral manifestations, periodontitis, chronic kidney disease

Introduction:

Oral manifestations in CKD are either due to disease itself or as a result of its therapy. Patients presenting with CKD are at high risk of developing oral health complications, such as narrowing of pulp chamber, enamel abnormalities, xerostomia, premature tooth loss, delayed tooth eruption, increased prevalence of calculus and periodontal disease, when compared to the general population (1). Poor oral health in CKD is being increasingly recognized as a significant risk factor for cardiovascular disease in this population by accelerating atherosclerosis (2). Periodontal disease in CKD has been associated with reduced serum albumin and protein energy malnutrition, another important cause of morbidity and mortality in this group of patients (2). Oral health education, periodic oral health assessment, early identification and treatment of periodontitis could possibly reduce risk of cardiovascular disease and improve survival and quality of life among patients with CKD.

Aims:

We aimed to study the spectrum of oral manifestations among patients with CKD and evaluate the prevalence and severity of periodontal disease in the study population.

We also sought to look for any possible existing difference in the oral health of Diabetic CKD patients compared to non-diabetics and the influence of CKD staging on oral manifestations.

Study Design & Population:

This study was designed as an observational, case control cross sectional study. The study was conducted by the joint efforts of the Nephrology & Orthodontics department of our institution. Institutional ethical committee clearance was obtained for the same. The study population was randomly selected from a group of stable CKD patients who attended nephrology outpatient department over a period of three months. A total of 100 such patients were recruited. An equal number of age and gender matched Control population was randomly selected from patients admitted in medical wards for other ailments. Patients with Psychiatric illness, malignancies and preexisting dental malformations were excluded from the study.

Methodology:

The following laboratory data were collected from patients in the study and control group – Complete hemogram, fasting blood sugar, blood urea, serum creatinine and serum albumin. Detailed oral examination was carried out by a single dental surgeon with the appropriate dental armamentarium. Patients were asked about uremic fetor, unpleasant taste, dry mouth and burning tongue. They were examined for oral lesions such as pale mucosa, dry fissured lips, Saburral tongue, candidiasis, petechiae, ecchymosis, smooth tongue, ulcerative stomatitis and angular cheilitis.

Periodontal disease index:

The prevalence and severity of gingivitis and periodontitis can be assessed using the periodontal disease index proposed by Ramfjord et al [3].

Components:

The three components are

1) Plaque Component
2) Calculus Component

3) Gingival and Periodontal Components

Scoring Methods:

Periodontal status of the mouth is scored by studying six selected teeth as per Ramfjord criteria. The six selected teeth are

16 Maxillary right first molar
21 Maxillary left central incisor
24 Maxillary left first premolar
36 Mandibular left first molar
41 Mandibular right central incisors
44 Mandibular right first premolar

Plaque component of Periodontal disease index:

The surfaces scored are the facial, lingual, mesial and distal

Scoring Criteria:

Score	Criteria
0	No plaque present
1	Plaque seen on some but not on all mesial, distal, buccal and lingual surfaces of the tooth
2	Plaque seen on all mesial, distal, buccal and lingual surfaces, but involving less than one half of these surfaces
3	Plaque seen over all mesial, distal, buccal and lingual surfaces, and involving more than one half of these surfaces

All areas are scored as one unit. The plaque score is obtained by totaling all of the individual tooth scores and dividing by the number of teeth examined

Plaque score of an individual =total score /No. of teeth examined

Calculus Component of periodontal disease index:

Presence and extent of calculus only on the facial and lingual surfaces are scored

Scoring Criteria:

Score	Criteria
0	No calculus seen
1	Supraliminal calculus involving less than 1 mm below the free gingival margin
2	Moderate quantity of supra and sub gingival calculus or sub gingival calculus alone
3	An abundance of supra and sub gingival calculus

The calculus score is obtained by totaling all the individual tooth scores and dividing by the number of teeth examined.

Calculus score of an individual=total score/no. of teeth examined

Gingival and Periodontal Components:

Scoring Criteria:

Scores	Criteria
0	No signs of inflammation
1	Mild to moderate inflammatory changes of gingiva not extending all around the tooth
2	Mild to moderate inflammatory gingival changes extending all around the tooth
3	Severe gingivitis characterized by marked inflammatory signs like redness, bleed tendency, swelling and ulceration
4	Gingival crevice seen in any of the four areas (mesial, distal,

	buccal, lingual), extending apically to the cemento- enamel junction but not more than 3 mm
5	Gingival crevice seen in any of the 4 areas extending apically to the cemento –enamel junction between 3-6mm
6	Gingival crevice seen in any of the four areas extending apically more than 6mm from the cemento – enamel junction

PDI Score =total of individual tooth score / no of teeth examined

Results

Of the 100 patients in the study group, 68 were males and 32 were females with an average age of 44.62 (±12.64). Among the 100 patients in the control group, 72 were males and 28 were females with an average age of 44.49 (± 16.69). The demographic, clinical profile and native kidney prevalence among study population are represented in tables 1,2 &3.

Dryness of mouth and unpleasant taste were the most common symptoms prevalent in 45% and 42% of the study group respectively. The prevalence of these symptoms was significantly higher than the control group. More than 50% of subjects in the study group had pale mucosa followed by smooth tongue (28%) and dry fissured lips (24%).

Diabetic patients constituted about 23 % of our study population. On comparing diabetic with non-diabetic CKD patients, there was a significantly higher prevalence of uremic fetor and xerostomia in diabetic CKD population. Signs of dry fissured lips, sabbural tongue, angular chelitis and candidiasis were numerically higher in diabetic patients with CKD though the difference was not statistically significant.

On subgroup analysis of the study population as patients with ESRD versus those with early stages of CKD, it was found that the ESRD group had a significantly higher prevalence of all the symptoms and signs examined.

Scoring of plaque index in the study group revealed that 19% of patients had score 1, 32% had score 2, and 49 % had score 3. The difference between the study and control group was statistically significant (Table 4) Similarly scoring of dental calculus, gingival and periodontal index was significantly higher in cases compared to control population – as displayed in tables 5& 6

Discussion:

Despite the increased prevalence of oral and dental disease in patients with CKD and its established association with several systemic diseases, attendance at dental clinics is infrequent, and physician as well as patient awareness of the problem is low [1]. CKD has been reported to affect the teeth, oral mucosa, bone, periodontium, salivary glands, tongue, mouth cavity and temporomandibular joint (2). Maintaining a healthy and functional dentition in CKD patients has an additional complementary role that most likely exceeds benefits seen in the general population. Our study highlights the importance of a structured and comprehensive oral health assessment in patients with CKD which would go a long way in identifying high risk patients at the earliest and instituting appropriate therapy. Akin to other studies, there was a higher prevalence of oral pathological lesions and periodontal diseases among CKD patients in our study.

Xerostomia [45%] and altered taste sensation [42%] were the two symptoms most commonly reported by our study population. In the study by Kho H S et al Xerostomia was reported in 32.9% of patients (4). Various factors contribute to xerostomia in CKD - decreased water intake, reduced salivary flow, salivary gland fibrosis, drug therapy (particularly Anti-Hypertensive agents) and oral breathing secondary to lung perfusion problems [5].

Protective function of saliva is lost in CKD patients making them more prone for dental caries, bacterial infections, candidiasis and periodontal disease. Xerostomia is frequently associated with loss of taste sensation. High levels of urea, dimethyl and trimethyl amines and low level of zinc might be associated with decreased taste perception in uremic patients [5]. These taste disturbances could also be caused by metabolic disturbances, the use of medications, a diminished number of taste buds, and changes in salivary flow rate and composition. Sour and sweet tastes can be more seriously affected than bitter and salty tastes [6].

Uremic fetor- ammonia like bad odor is an often-reported disturbing symptom in CKD attributed to the high urea content in saliva and its subsequent breakdown to ammonia.

Saburral tongue is an asymptomatic finding due to filling of filiform papillae with dead leucocytes and epithelial cells. Saburral tongue may also be caused by anaerobic bacteria on the tongue surface which secretes volatile sulfurous compounds [7]. Saburral tongue was noted in 17 % of our study population and none in the control group.

Periodontal disease is a spectrum of disease involving inflammation of gingival tissues caused by plaque accumulation, ranging from gingivitis alone to substantial inflammatory destruction of supporting periodontal tissue (Periodontitis). In periodontally diseased population, there is a higher prevalence of gram negative organisms compared to the normal gram-positive organisms in the subgingival sulcus [8] Polymorphonuclear leucocytes(PMN) acts as a first defense mechanism against periodontal disease. PMN traverses the junctional epithelium and migrates into the gingival sulcus creating a protective barrier against bacterial plaque. Decreased and defective PMN function often leads to advanced periodontal disease. PMN impairment is well documented in CKD patients [9].

Periodontal disease index (PDI) was first introduced by Ramfjord [3]. In our study, each of the three components - plaque, calculus, gingival and periodontal components was scored in six selected teeth as per Ramfjord criteria.

With respect to the plaque component scoring, nearly 50 % of patients with CKD had severe plaque score of 3 compared to only 23% in the control group (Table 4).

More than 50 % of patients had calculus component scoring > 1 and the results were statistically significant (Table 5). Increased calculus deposition is attributed to poor oral hygiene, alterations in serum phosphorous calcium balance and changes in composition of saliva. Plaque and calculus can lead to increased loss of periodontal attachment in CKD patients

High Gingival and periodontal component scoring (scores 5 -6 representing severe periodontitis) was found only in the study group (20%) in comparison to none in the control group. Nearly half of the subjects in the control group had a gingival and periodontal score of 0(Table 6).

Our results point to the much higher prevalence of oral lesions and moderate to severe periodontal disease in patients with chronic kidney disease reflecting the findings of other Indian and western data [10 - 14].

On subgroup analysis, there was a significantly higher prevalence of uremic fetor, xerostomia, candidiasis, dental calculus, gingival and periodontal disease in diabetic CKD patients when compared to non-diabetic CKD patients. In a study by Shu Fen et al diabetic uremic patients undergoing maintenance hemodialysis exhibited a potentially higher risk for dental decay and xerostomia compared to non-diabetic CKD population [15]

Another observation in our study was that patients with ESRD seemed to have poor oral health in terms of symptoms reported

by patients compared to those with earlier stages of CKD.

Though the association between the chronic inflammatory state in periodontal disease with cardiovascular mortality is amply supported by literature evidence [16], a cause and effect relationship however could not be established. A bidirectional relationship between periodontal disease and CKD has been demonstrated in the study by Fischer et al [17], meaning each being a risk factor for the other. Hence there is compelling evidence over the last two decades on the importance of improving oral health in our CKD population.

Regular tooth brushing, flossing and periodic professional dental cleaning should be encouraged to reduce the incidence of gingivitis and periodontitis [18]. Patients should be educated on the importance of oral health care and advised on avoidance of smoking, alcohol and excess caffeine intake. Mechanical debridement of dental calculus, commonly known as tartar, which represents mineralized bacterial plaque can effectively prevent the initiation and progression of periodontal diseases [19-20].

Comprehensive oral health assessment should be made a part of routine standard of care in managing patients with CKD.

Limitations:

Ours was a cross sectional study with a sample size not large enough to look into the real prevalence of oral health issues considering the huge disease burden of CKD. Our findings may be limited as only physical examination of periodontal disease was made and the effect of biochemical markers (Serum calcium, serum phosphorus, serum hsCRP) on periodontal disease was not evaluated. Considering that a majority of our patients are from poor socio-economic background with low literacy rate, an inclusion of questionnaire on oral hygiene practices of patients would have highlighted its role in the complex interplay of factors linking periodontal disease and CKD.

Conclusions:

We conclude that there is a higher prevalence of oral pathological lesions and moderate to severe periodontal disease in patients with CKD. Diabetic patients with CKD and ESRD patients on dialysis may be at an even higher risk for poor oral health compared to non-diabetics and those with earlier stages of CKD. Concerted effort of both nephrologists and dental professionals is the need of the hour to combat this important often overlooked problem. Comprehensive oral health assessment should be made a part of routine standard of care in management of patients with chronic kidney disease.

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Table 1 : Demographic Profile of study population

		Study group	Control group
No of individuals (n)		100	100
Gender	Male	68	72
	Female	32	28
Age range (years)		16-70	16-75
Mean ± SD (years)		44.62± 12.64	44.49 ± 16.69
Smoker		25	32
Alcoholic		13	22
SHT		24	17
DM		26	28
CKD		100	0

Table 2: Clinical profile of study Population

Laboratory Results	Study Group	Control Group	P value
N	100	100	
Total Count (cells/mm$^{3)}$	6844.3 ±2327	7030.5 ± 1593	0.510, NS
Hemoglobin(g/dl)	8.35± 2.4	12.7 ± 12	0.000,S
RBS (mg/dl)	119 ± 53.6	122.5 ± 55.2	0.667,NS
Blood urea (mg/dl)	119.65 ± 50	30.1 ± 3.4	0.000,S
Srcreatinine (mg/dl)	7.54 ± 7.2	0.82 ± 0.16	0.000,S
SrAlbumin(g/dl)	3.0 ± 0.6	3.3 ± 0.2	0.000,S

Table 3: Etiology of CKD in study group

Cause of CKD	No
Native kidney disease –Not known	50
Diabetic nephropathy	23
CIN	6
Obstructive nephropathy	3
Cresentic GN	2
Analgesic nephropathy	1
Others	15

Table 4: Comparison of plaque index scoring in CKD and non-CKD patients

Parameter	Study group	Control group	Total	Statistical analysis
Score 0	0	3	3	P= 0.000, S
Score 1	19	38	57	
Score 2	32	36	68	
Score 3	49	23	72	

Table 5: Comparison of calculus index scoring in CKD & non-CKD population

Parameter	Study group	Control group	Total	Statistical analysis
Score 0	16	37	53	P=0.003, S
Score 1	24	26	50	
Score2	33	21	54	
Score 3	27	16	43	

Table 6: Scoring of gingival and periodontal index in the study group

Parameter	Study group	Control group	Total	Statistical Analysis
Score 0	16	42	58	
Score 1	24	27	51	
Score 2	17	8	25	P=0.000, S
Score 3	11	9	20	
Score 4	13	14	27	
Score 5	17	0	17	
Score 6	2	0	2	

Fig 1: Distribution of various symptoms and signs in CKD and non-CKD patients (in percentage)

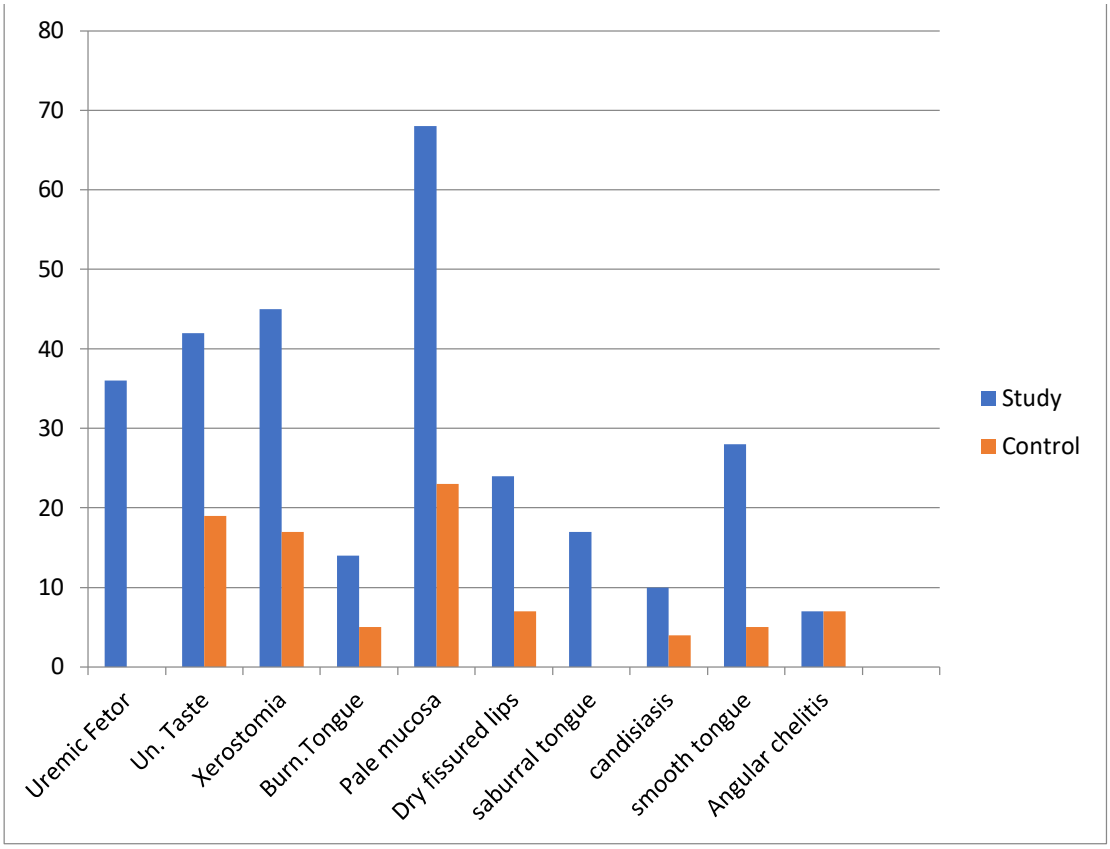

Fig 2: Distribution of various symptoms and signs in diabetic and non-diabetic CKD patients (in percentage)

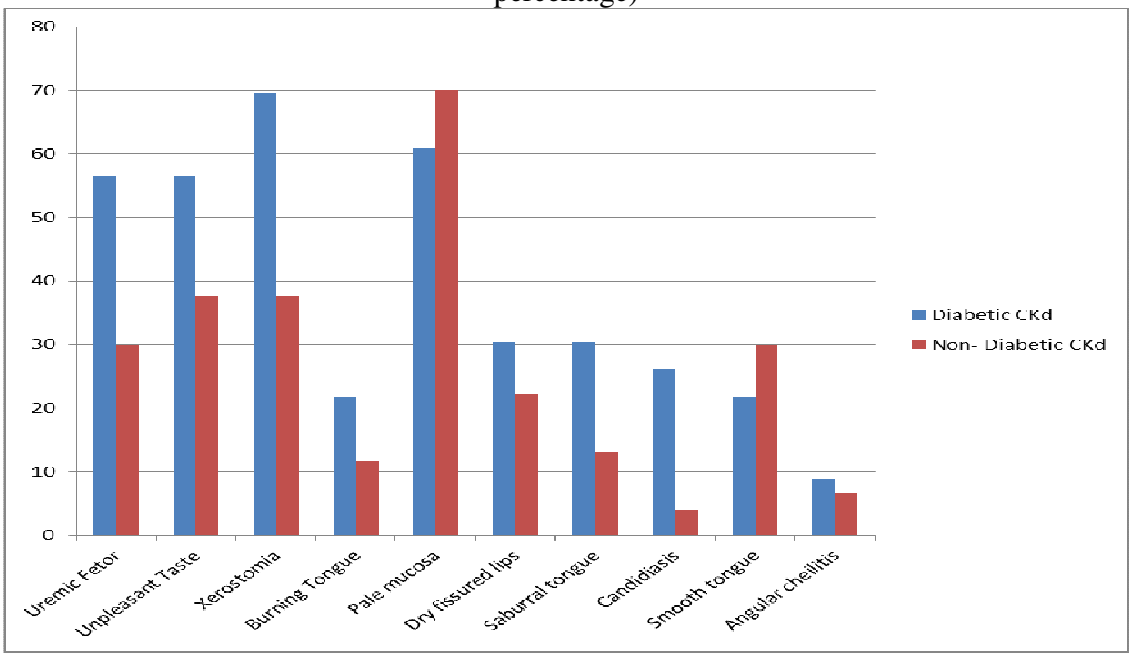

Fig 3: Distribution of various symptoms & Signs in ESRD and non ESRD patients (in percentage)