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Oral hygiene practice, dental profile and dental service utilization of chronic kidney disease patients

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Abstract

Background: Research has shown that as high as 90% of patients with renal disease show oral symptoms. Literature supports a bidirectional relation between CKD and periodontal disease.

Methods: A cross-sectional survey among patients diagnosed with CKD who attended the renal outpatient clinic of a teaching hospital in south-south, Nigeria. Self-administered questionnaire was used to collect participant's demographics and dental profile. Oral hygiene gingival and dental status were assessed with Simplified oral hygiene index (OHI-S), gingival index and DMFT. Data analysis was done with IBM Statistical Package for Social Science (SPSS) for windows version 21.0 and results presented as tables.

Results: One hundred and seven consenting participants were recruited for the study. Age ranged between18 and 86 years with mean age of 52.93±5.74 years. Median year of diagnosis was 4 years. Hypertension was the major cause of CKD in three-quarters of participant, two-third were in the 4th stage of disease, 95.3% used toothbrush/paste to clean their teeth, 14% brushed twice daily and 18.7% reported interdental cleaning. Only 9.3% of participants regularly visit the dentist and reasons for non-regular visit varied. Four-fifth of participants had poor oral hygiene. Mean OHI-S was 4.52 ±1.46. Four-fifth of participants reported gingival bleeding while brushing. 87.9% had gingival index of 2 and 3. A quarter had xerostomia. Mean DMFT was 0.39±0.87.

Conclusion: The oral health status of participants was poor. Oral health care should be incorporated into the management of patients with chronic kidney disease as this will help improve their quality of life.

Keywords: CKD; Dental visit; Dental profile; Gingival status; Oral hygiene status

1. Introduction

Oral health has been defined as the ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort and disease of the craniofacial complex [1]. Association has been reported between poor oral hygiene and chronic renal disease (CKD) [2].

Chronic renal disease (CKD) is defined as kidney damage or glomerular filtration rate of <60Ml/min/1.73m^2 for ≥3 months [2]. Kidney damage is the structural or functional abnormalities of the kidney without decreased GFR initially but which over time can lead to decreased GFR [2, 3]. CKD has been associated with several oral changes in ninety percent of those diagnosed [3].

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These oral changes are periodontal disease, dental caries, gingival enlargement as a side effect of some renal drugs and changes in salivary composition and rate leading to xerostomia [3-5]. The most common oral finding reported was pallor of the oral mucosa [6].

CKD is a non-communicable disease usually caused by diabetes and hypertension [7]. it is defined by the National Kidney Foundation (NKF) as kidney damage occurring for three or more months that is associated with structural or functional abnormalities with or without decreased glomerular filtration rate (GFR) [7-10].

CKD is classified into acute, subacute, and chronic renal failure based on onset and the possibility for recovery of the structural lesion. Although acute renal failure is reversible in most cases, chronic renal failure (CRF) presents as a progressive disease that ends in terminal renal failure (TRF) even if the cause of the initial nephropathy disappears [11, 12].

The global prevalence of CKD in 2017 was 9.1% accounting for roughly 700 million cases worldwide and was responsible for 1.2 million deaths [13]. It was the fifth cause of death in Latin America.[12] CKD is a growing challenge in low- and middle- income countries in Sub-Saharan African with 16% recorded as pooled prevalence [14, 15]. In Nigeria, the prevalence of CKD is 1.8% to 43.5% depending on the studied population [16].

Oral bacteria that are present in dental plaque can disseminate through circulating blood during swallowing and induce systemic changes in distant tissues in the body [17]. Between 10^6–10^8 of Porphyromonas gingivalis and Tannerella forsythia have been reportedly found per mL of subgingival and salivary samples in periodontitis patients and some of these can be swallowed daily [18]. Oral bacteria can enter the circulation and cause bacteremia by actively crossing the periodontal epithelium [18, 19]. The direct or indirect effects of circulating bacteria, inflammatory mediators and immune complexes from infected or inflamed periodontal tissues on other body sites are some of the main mechanisms that contribute to systemic inflammation [19]. There is strong evidence that the pathogenic microbiota and chronic inflammation established in poor oral hygiene contribute to the progression of CKD [20, 21].

Dental caries is a biofilm-mediated disease with multiple contributing factors that drives net localized demineralization of the teeth [22]. Dental caries is prevalent, and if untreated it has a direct effect on both the oral and systemic health [20, 23]. Though, dental caries and periodontitis- a sequalae of untreated gingivitis due to poor oral hygiene, are both biofilm-mediated diseases, the pathogenesis of dental caries is complex and multifactorial and differs from periodontal disease [22]. The ability of oral microbiome to spread into systemic circulation from dental caries is plausible and would parallel mechanisms that already have been studied for periodontal disease [24].

This study assessed the oral health of chronic kidney patients in a tertiary hospital in Nigeria.

2. Material and methods

A descriptive cross-sectional study conducted between June and September 2021 at the renal outpatient clinic of University of Port Harcourt Teaching Hospital (UPTH)) in South-South, Nigeria. Ethical approval was obtained from the ethics committee of the hospital.

The inclusion criteria were patients 18 years and above diagnosed with chronic kidney disease for at least 1 year before the study, gave consent to be part of the study and are permanent residents in the study location. Those who smoked or consumed alcohol were excluded from the study. One hundred and seven subjects who gave consent were recruited.

Self-administered questionnaires were used to collect data on demographics, CKD and dental profiles. Oral cleanliness was assessed using Simplified Oral hygiene index by Greene and Vermillion [25, 26] and gingival status assessed with gingival index by Loe and Silness [27]. Classification of CKD was done based on National Kidney Foundation (NKF) 2019 (Kidney Disease Outcomes Quality Initiative) KDOQI guidelines [28].

The OHI-S is a composite index that scores debris and calculus deposition on selected teeth. It was developed by Greene and Vermillion in 1964. It is expressed as the sum of the mean debris index (DI-S) and calculus index (CI-S) of the examined teeth. The OHI-S is interpreted as follows: Score 1 (good oral hygiene) = 0.0 – 1.2, Score 2 (fair oral hygiene) =1.3 – 3.0, Score 3 (poor oral hygiene) = 3.1 – 6.0.

Gingival index (GI) may be used for the assessment of prevalence and severity of gingivitis in populations, groups and individuals. A score from 0-3 with 0 = No inflammation; 1 = mild inflammation; 2 = moderate inflammation and 3 signifies severe inflammation.

Decayed, missing and filled teeth (DMFT) index was used to assess dental status [29]. DMFT is the sum of the number of Decayed, missing due to caries, and filled teeth in the permanent teeth. The mean number of DMFT is the sum of individual DMFT values divided by the sum of the population

The KDOQI guidelines categorized CKD into 5 stages. Stage 1 is Normal or high GFR (GFR > 90 mL/min); Stage 2 = Mild CKD (GFR = 60-89 mL/min); Stage 3A = Moderate CKD (GFR = 45-59 mL/min); Stage 3B = Moderate CKD (GFR = 30-44 mL/min); Stage 4 = Severe CKD (GFR = 15-29 mL/min); Stage 5 = End Stage CKD (GFR <15 mL/min.

Data was analyzed using the Statistical Package for Social Sciences version 20.0 (IBM SPSS Statistics Armonk New York. The results were presented as tables.

3. Results

Table 1 shows participants' demographics. Age ranged between18 and 86 years with mean age of 52.93±5.74 years. There was a male predominance with M: F of 1.43: 1 and median year of diagnosis was 4 years. Hypertension was the cause of CKD in three-quarters of the participants. Two-third were in the 4th stage of disease.

Table 1 Participants' characteristics

Variables	Frequency	Percentage
Sex		
Male	63	58.9
Female	44	41.1
Age group (years)		
10-21	2	1,9
21-30	8	7.5
31-40	16	15.0
41-50	23	21.5
51-60	20	18.7
61-70	25	23.4
>70	13	12.0
Mean age = 52.93 ±5.74 years		
Ethnicity		
Hausa	1	0.9
Igbo	12	11.2
Yoruba	5	4.7
South-South	89	83.2
Education		
No formal	13	12.1
Primary	16	15.0
Secondary	36	33.6
Tertiary	42	39.3
Occupation		
Students	3	2.8
Self-employed	62	57.9
Civil servants	27	25.3
Professionals	15	14.0

Year of Diagnosis (years)			
<5		93	86.9
5-10		11	10.3
>10		3	2.8
Mean age of diagnosis = 5.17±2.55 years; median year of diagnosis = 4 years			
Cause of CKD			
Hypertension		80	74.8
Diabetes		10	9.3
Nephritis		11	10.3
Obstructive uropathy		3	2.8
Systemic Lupus Erythematous (SLE)		2	1.9
HIV		1	0.9
CKD classification based on NKF KDOQI guidelines			
Stage 1 (GFR > 90 mL/min		6	5.6
Stage 2 (GFR = 60-89 mL/min)		2	1.9
Stage 3 (GFR = 45-59 mL/min or GFR = 30-44 mL/min)		29	27.1
Stage 4 (GFR = 15-39 mL/min)		43	40.2
Stage 5 (GFR <15 mL/min)		27	25.2
Dialysis			
Yes		41	38.3
No		66	61.7
General medical condition			
Diabetes	Yes	22	20.6
	No	85	79.4
Hypertension	Yes	91	85.1
	No	16	14.9
Current medication			
Antihypertensives		91	85.1
Antidiabetics		8	7.5
Calcium carbonate		3	2.8
Oral iron tablets		2	1.9
Diuretics		1	0.9
Erythropoietin		1	0.9
Others		1	0.9
Total		107	100.0

Majority of participants used toothbrush and paste to clean their teeth with only 14% brushing twice daily. 57% used medium bristled toothbrush. 18.7% of participants claimed to clean interdentally. Table 2.

As regards dental service utilization, only 9.3% of participants regularly visit the dentist. Reasons for non-regular visit varied. Table 3.

Participants dental profile showed that four-fifth of participants had poor oral hygiene. Mean OHI-S was 4.52 ±1.46. Four-fifth of participants reported gingival bleeding while brushing. 87.9% had gingival index of 2 and 3. A quarter had

xerostomia. Mean Decayed, Missing, and Filled Teeth (DMFT) was 0.39±0.87. The mean differences between the different components of teeth including DMFT were smaller Table 4.

Table 2 Participants oral hygiene practice

Variables	Frequency	Percentage
Cleaning items		
Toothbrush/paste	102	95.3
Toothpaste/chewing stick	2	1.9
Chewing stick	3	2.8
Frequency of cleaning		
Once daily	91	85.0
Twice daily	15	14.0
After every meal	1	1.0
Toothbrush bristled		
Soft	23	21.5
Medium	61	57.0
Hard	23	21.5
Interdental cleaning		
Yes	20	18.7
No	87	81.3
Interdental cleaning materials		
Dental floss	6	30.0
Interdental brush	1	5.0
Toothpick	13	65.0
Interdental cleaning period		
After brushing	2	10.0
After eating	15	75.0
Anytime	3	15.0
Total	107	100.0

Table 3 Participants' dental service utilization

Variables	Frequency	Percentage
Regular dental visit		
Yes	10	9.3
No	97	90.7
Past dental visit		
Yes	37	34.6
No	70	65.4
Total	107	100.0
Reasons for past dental visit		
Routine check-up	4	10.8
Cleaning (Scaling & Polishing)	17	46.0

Extraction	16	43.2
Total	37	100.0
Reasons for non-utilization		
No time	42	43.3
No dental problem	18	18.6
High cost of treatment	24	24.7
Far distance	13	13.4
Total	97	100.0

Table 4 Participants dental profile

Variables	**Frequency**	**Percentage**
Simplified oral hygiene index (OHI-S)		
Fair (1.3-3.0)	20	18.7
Poor (3.1-6.0)	87	81.3
Mean OHI-S = 4.52 ±1.46		
Mean plaque score = 2.31 ±0.75		
Self-reported gingival bleeding		
Yes	84	78.5
No	23	21.5
Self-reported severity of gingival bleeding		
Mild	11	10.2
Moderate	48	44.9
Severe	48	44.9
Gingival index		
1	13	12.1
2	45	42.1
3	49	45.8
Gingival recession		
Yes	59	55.1
No	48	44.9
Periodontal pocket		
Yes	10	9.3
No	97	90.7
Periodontitis		
Yes	69	64.5
No	38	35.5
Halitosis		
Yes	54	50.5
No	53	49.5
Xerostomia		
Yes	26	24.3
No	81	75.7

Change in taste		
Yes	51	47.7
No	56	52.3
Total	107	100.0
Teeth variables	Mean (95% CI) (N = 107)	
Teeth present	31.31 (30.93, 31.70)†	
Missing teeth	0.59 (0.26, 0.94)†	
Carious teeth	0.21 (0.04, 0.37)†	
Filled teeth	0.09 (0.04, 0.23)†	
DMFT	0.39 (0.23, 0.59)†	

† Denotes non-overlapping 95% confidence intervals

4. Discussion

With the increase in the prevalence of CKD in Nigeria, there is the need to promote oral health among the populace as those diagnosed with the condition require holistic care. Ninety percent of those diagnosed have been reported to have associated oral symptoms [3]. This study evaluated the oral health of Nigerians diagnosed with chronic kidney disease.

Participants' age ranged from 18 years to 86 years with mean age of 52.93±5.74 years. This is comparable to a study done among aboriginal Australians that reported a mean age of 48.11 years [7]. This study reported a male predominance like the Australian study and the one among CKD patients in Government hospitals in India [7, 11]. Half of the participants in this study were in the 31-60 years age group. The prevalence of CKD increased with age in this study group and compares with the Indian study [11]. 25% of participants older than 60 years had estimated GFR of less than 60 ml/min/1.73 m^2. The Indian study reported that 17% of participants older than 60 years had GFR less than 60ml/min [11].

Though, the aetiology of kidney disease is multifactorial, hypertension and diabetes were the most common causes worldwide [30]. In the United State of America, hypertension and diabetes were reported as the major cause of 3 out of 4 new cases [31]. In developing countries, glomerulonephritis and interstitial nephritis were reported as the commonest causes [32]. In this study, the two major causes in the participants were hypertension (74.8%) and nephritis (10.3%). Other studies done in Nigeria reported high prevalence of hypertension among their study participants [16, 33-35].

CKD patients have been reported to present with xerostomia (dry mouth), candidiasis, alteration in taste, periodontitis, dental caries and tooth loss [6,36]. Taste alteration is commonly reported among CKD patients although the underlying mechanism is not well understood. The change in taste among the participants may be from the effect of ureamic toxins on the central nervous system (CNS) and the peripheral nervous system (the taste receptors) [37]. The occurrence of dry mouth may be as a result of fluid restriction, electrolyte imbalance and use of drugs that have xerostomia as side effects. Halitosis has been attributed to poor oral hygiene and uremic smell [36].

The participants that presented with altered taste, xerostomia and halitosis in this study were 50.5%, 47.7% and 24.3% respectively. The study done among CKD patients in a teaching hospital in Ile-Ife Nigeria reported that 26%, 22.2% and 12% of their participants had alteration in taste, xerostomia and halitosis respectively [8]. Other studies reported prevalence of xerostomia of 32.9% and 48.2% among their participants [38, 39]. Another study done among CKD patients in a teaching hospital in Lagos, Nigeria reported a prevalence of 36.9% of altered taste among participants.[39] Similar to the Lagos study that reported prevalence of candidiasis among participants as only 1.5%, this study reported a 1.9 % prevalence [39].

Gingival bleeding, the first sign of gum inflammation, is seen commonly in poor oral hygiene. This will lead to periodontal disease if the gingival inflammation is left untreated. About two-fifth of participants in this study reported gingival bleeding. Clinical examination showed that 100% of participants had gingivitis and 64.5% had periodontitis. 9.3% and 55.1% of participants had periodontal pocket and gingival recession respectively. The Ile-Ife study reported gingival/periodontal inflammation among 97.7% of participants [8].

This study did not report gingival hyperplasia among participants despite that majority (81.3%) of participants had poor oral hygiene similar to the Ile-Ife study [8]. Gingival swelling secondary to use of nifedipine and cyclosporine have

been reported among CKD patients [35]. However, hypertension is treated in most Nigerian teaching hospitals with amlodipine [39]. Also, most patients with CKD in Nigeria usually cannot afford renal transplant and would not need to be placed on immunosuppressants [35, 40-42].

Less than 10% of participants visit the dentists regularly despite the associated oral conditions secondary to CKD and 81.3% had poor oral hygiene. CKD patients have been reported to have reduced dental visits which further worsen their oral conditions [43]. This may be as a result of the high financial and emotional burdens CKD places on those diagnosed and also because most Nigerians don't present early to the health facilities when sick. They usually wait until they have tried various forms of alternative medicine (spiritual and traditional/native healers) [44-46]. This attitude may probably be as a result of ignorance and the poor accessibility and lack of affordable oral health care services [8,46].

Tooth loss is the sequalae to untreated periodontal disease. 52% of participants had periodontitis. This is not surprising as four-fifth had poor oral hygiene. The values of the mean differences between the different components of teeth including DMFT at 95% confidence interval were smaller compared to that reported by the Australian study [5]. This may be because most of the participants had full complement of teeth.

5. Conclusion

The oral hygiene and dental status of the participants as well as the use of dental services was poor.

Compliance with ethical standards

Acknowledgments

All individuals who participated in the study.

Disclosure of conflict of interest

The authors declare no conflict.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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