ACTA SCIENTIFIC DENTAL SCIENCES

Volume 9 Issue 2 February 2025

Research Article

Oral Manifestations of Chronic Kidney Disease

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DOI: 10.31080/ASDS.2025.09.1975

Received: January 07, 2025

Published: January 25, 2025

Abstract

Background: Chronic kidney disease (CKD) is one of the most common global health burdens. This suggests that the oral health concerns of this population are easily overlooked, particularly among developing countries like the UAE. Hence, the present study aims to assess the nature and prevalence of oral manifestations among patients with CKD undergoing hemodialysis in the UAE.

Methods: This was a cross-sectional observational study with a mixed-methods approach. A total of 100 CKD patients on hemodialysis for at least one year were recruited from four hospitals in UAE. Data collection involved surveys using questionnaires, clinical oral examinations, and review of medical records.

Results: The prevalence of a wide range of oral lesions was high, amounting to 73.3%. Periodontal changes were the most prevalent, occurring in 54.0% of subjects, followed by dry mouth in 40.0%, taste changes in 23.0%, and mucosal pallor in 23.0%. There were weak correlations with patient characterization variables regarding oral lesions, suggesting that oral health challenges may be more associated with CKD-related factors than demographic characteristics.

Conclusion: The findings underscore the urgent need to integrate comprehensive oral health assessment and care into routine management of patients with CKD in the UAE. Interventions at the practice, organizational, and structural levels will be required, and this will call for enhanced collaboration between nephrologists and dental professionals to better address the oral health needs of this patient population and pave ways for evidence-based policy formulation.

Keywords: Oral Manifestation; Chronic Kidney Disease; Research Protocol

Introduction

Chronic kidney disease (CKD) has become a prevalent and rising global health problem associated with serious adverse outcomes of increased risk of cardiovascular disease and premature death [1]. In its estimation, the WHO indicated that over 10% of the global population is affected by CKD [2]. Millions die every year due to lack of access to affordable treatment for this disease. The prevalence of CKD at this point is estimated to be around 4.6% of the adult population in the United Arab Emirates, caused mainly by two factors: diabetes and hypertension [3.4]. A relationship between oral health and systemic diseases has long been established, with growing evidence for a bidirectional link between oral health and kidney function [5]. Poor oral health in CKD patients is considered an under-recognized risk factor for increased cardiovascular disease, still the biggest killer of this population [6]. Several studies have demonstrated links between periodontitis and coronary heart and cerebrovascular diseases not only in the general population but also among hemodialysis patients [7].

Despite the growing body of evidence pertaining to the importance of oral health in CKD patients, little attention has really been directed toward oral healthcare, especially in developing countries that bear a greater burden from renal diseases. Little, however, has been done in the UAE to study or address the specific oral healthcare needs for CKD patients, even while the country has made significant progress toward tackling the problem of CKD. Many oral

manifestations are common in CKD patients. Among them, xerostomia is a frequent complain due to fluid restriction, medication side effects, and altered salivary gland function [8]. Changes in taste have been also reported by these patients and described as associated with uremic toxins, medication side effects, and zinc deficiency [9]. Another concern is halitosis or bad breath, which is usually incubated due to high levels of urea in saliva and poor oral hygiene [10,11]. Periodontal disease was also more frequent and more severe in patients with CKD, and it may contribute to general systemic inflammation [12,13]. CKD patients may also experience mucosal lesions, such as uremic stomatitis, oral candidiasis, and hairy leukoplakia, especially in the presence of immunosuppression [14-16]. Finally, there is an increased formation of dental calculus due to disorders in calcium and phosphate metabolism [11].

Such manifestations in the context of UAE health care need to be understood, although the relation between CKD and oral health is complex. Prevalence rates for oral manifestations in CKD patients have been reported in previous studies conducted in other countries [17-19], but there is no data available on the UAE population. This will, thus, be relevant to a study on oral manifestations in patients with CKD in the population of the UAE, which has a particular demography, dietary habits, and healthcare organization. The need for this study is due to the fact that poor oral health contributes to other important aspects of health and care for patients suffering from CKD. Non- managed oral lesions may lead to chronic inflammation, poor nutrition, and increased susceptibility to infection, further complicating the treatment of CKD and its implications for transplantation of the kidney [20].

It was set to fill the gap that existed and provide substantive answers useful to practice and policy formation in the UAE. The general objective of this study was to determine the type and prevalence of oral lesions in patients with CKD on hemodialysis of one year or more in the UAE. Specifically, it aimed at determining:

- The prevalence of CKD-related oral lesions was to be determined.
- Compare prevalence of signs and symptoms to establish the most common ones that depict oral manifestations of CKD.
- This study establishes the relationship of oral lesions with gender and age.
- Propose oral health management care plans for patients with CKD within the health system of the UAE.

This study is likely to have a substantial impact on patient care and quality of life with the advancement of our knowledge of oral health challenges among patients with CKD. The findings from the current study could set the background for relevant targeted interventions and give rise to increased collaboration between nephrologists and dental specialists to improve the quality of life for CKD patients in the UAE.

Literature Review

The association between chronic kidney disease (CKD) and oral health has gained a lot of attention in the recent past. The present literature review aims to discuss the current state of knowledge regarding the prevalence of OM's in patients with CKD with special emphasis on articles related to the UAE.

Levey et al offered a definition, classification and prognosis of CKD in their KDIGO Controversies Conference Report [1]. This report has been helpful in reviewing/revising the practice approach to CKD around the world. The authors suggested a new classification according to the cause, glomerular filtration rate (GFR) category, and albuminuria category. Since then, this system has been popularized and is referred to as the CGA classification, which enhanced the applicability of predicting few outcomes and managing CKD patients [2]. In response, Kovesdy addressed the second challenge by providing an epidemiological update of CKD, and the threats it poses to global healthcare [2]. The author mentioned that there is 29.3% increase of CKD worldwide since 1990 because of factors such increases in population, aging and number of risk factor like diabetes, hypertension, among others. Kovesdy, moreover, emphasized the economic burden of CKD, citing that it costs lots of money and takes 1–3% of the annual health care expenditure in the economically developed countries [2].

Jha et al., in their review of CKD in relation to the UAE, have highlighted the global and international relation and orientation of the disease in giving meaning to its occurrence in developing countries. The authors pointed out that developing nations experience restricted access to RRT, lack of qualified staff in nephrology, and improper infrastructure for CKD diagnosis and management. They pointed out the importance of more focused and managed care of patients with CKD in these environments, with appropriately adapted resources to local context and healthcare systems [3]. The study by Ansell and Feest in the UK Renal Registry Report provided estimates of the burden and treatment of renal disease that will be useful to benchmark with UAE [4]. This complete report furnished incidence and prevalence rate of RRT, survival data plus datapoints portraying the quality of care received [4]. It is appreciated that the medical care associated with the UK and UAE is dissimilar, however this report is an example of the nature of data gathering and analysis that could be advantageous to CKD in the UAE.

Oral health and systemic diseases

The connection between oral diseases and other system diseases is well documented and there is growing evidence of a two-way interaction mechanism between oral health and kidney functions. Sharma et al. showed a positive correlation between periodontitis and mortality in CKD stages 3- 5., emphasizing the need for maintaining oral health for patients with CKD [5]. In the study using data from the Third National Health and Nutrition Examination Survey (NHANES III), the researchers observed that people with periodontitis had a 41% higher risk of death than those with no periodontal disease once potential confounding variables were accounted for [5].

Grau et al. gave first indication of the relationship between acute cerebrovascular ischemia and chronic and recurrent infection, oral infection in particular [6]. This research contributed to subsequent examinations of the relationship between oral health and systemic diseases. The authors noticed that recently acquired and persistently present bacterial and viral infections were more often encountered in patients with cerebrovascular ischemia compared to controls, which may indicate that infections play a role in the development of cerebrovascular ischemia [6]. Especially, for periodontal disease in ESRD patients, Kshirsagar et al. demonstrated that this disease reduces survival rates significantly [7]. There is an implication of the need to enhance oral health of patients with CKD if their global health is to improve. It was detected that severe periodontitis increased the general mortality risk by 41% within the 18 months of follow up [7]. This fact brings out the potential contribution of the oral health interventions towards the enhancement of treatment of CKD.

Oral manifestations in CKD patients

Oral complications in patients with CKD Oral lesions in patients with CKD are not uncommon and include the following. Asha et al disclosed the relationship between DM CKD and oral manifestations in diabetic and non-diabetic patients undergoing hemodialysis by comparing the two conditions [8]. This study concluded that diabetic CKD patients were more likely to have oral complications than non-diabetic CKD patients, especially concerning periodontal diseases and oral mucosal lesions. Scully and Cawson gave a detailed account of oral lesions in genitourinary and renal diseases, which would be of use to both dental surgeons and the nephrologist [9]. They have been instrumental in establishing the cross-sectional nature of oral health concerns in CKD patients. They outlined various oral complications, such as uremic stomatitis, gingival hypertrophy, and changes in salivary content and concentration. The authors also pointed out that medication-related oral side effects also deserve attention in CKD patients, because many medicinal drugs have an impact on the oral cavity [9].

Specific oral manifestations in CKD patients have been extensively studied:

- **Xerostomia (dry mouth):** Mainali and Chettri studied xerostomia and other oral complications in patients on hemodialysis and evaluated patients' awareness and perception of oral health [10]. They pointed out that xerostomia was common among their patients and that more patients should be made aware of this condition. According to the study, 68% of the patients on hemodialysis complained of xerostomia that affected their quality of life. According to the authors, primary care for CKD patients should include oral health education.
- **Taste changes:** A cross-sectional study in Shiraz, Iran, assessed several oral conditions in patients on hemodialysis, including changes in taste perception [11]. This study offered useful information regarding the incidence and type of taste disorder among the CKD patients. Patient experience was also examined, showing that 35% of patients could affirm changes in their taste perception, with the most common manifestation being the metallic taste. The authors proposed a process by which taste alterations may exacerbate nutrition loss in CKD patients and encouraged systematic taste studies in dental patient exams [11].
- **Halitosis:** The study by Afroozi., *et al*. also highlighted this aspect, considering it as one of the most frequent oral complications in CKD [11]. In their study, they revealed that 31% of their participants suffered from halitosis. The authors pointed out that the causes of halitosis in CKD patients include: plaque accumulation, gingival inflammation, xerostomia, and the presence of some chemical compounds in saliva [11].
- **Periodontal disease:** Craig studied the associations between chronic renal disease and periodontal disease to have a better understanding of their reciprocity [12]. The author suggested that CKD could contribute to worsening periodontal disease through several pathways, such as immune dysfunction, increased inflammation due to uremia, and the side effects of medications. On the other hand, periodontal disease was postulated to deteriorate CKD by way of increasing systemic inflammation and bacteremia [12]. For instance, Eke et al. provided the data on prevalence of periodontitis among adults in the USA that may be used for comparison to other regions such as the UAE [13]. In their NHANES 2009-2010 study, they determined that 47% of the adults who are 30 years old and above had periodontitis, with 8. 5% having severe periodontitis [13]. Although not directly associated with CKD patients it is important to look at the above data in order to understand the general prevalence of periodontal disease.

- **Mucosal lesions:** Sunil., *et al*. provided an overview of the entire spectrum of orofacial manifestations in renal diseases, including various mucosal lesions [14]. Their review described some lesions like uremic stomatitis, angular cheilitis, and lichenoid reactions. The authors bid emphasis on the fact that these should be identified at an early stage and managed to avoid complications and enhance patient comfort [14]. Kuravatti., *et al*. further elaborated the oral manifestations of CKD, adding data on the broad spectrum of mucosal lesions in CKD patients. They reported rather infrequent but clinically significant lesions such as uremic frost and enamel hypoplasia [15]. The authors put an emphasis on the need for dental professionals to know such manifestations so that they could provide holistic care to the patients with CKD.
- **Dental calculus formation:** In the oral findings in hemodialysis patients, Afroozi et al. included dental calculus formation, which pervades the lore of this common problem in CKD patients [11]. In their study population, the authors found a very high prevalence of dental calculus (78%). They attributed the same to altered calcium phosphate metabolism and reduced salivary flow in CKD patients.

Oral health knowledge and care in CKD patients

Sarumathi et al. assessed primary care physicians for their awareness and knowledge in regard to common oral diseases [16]. Descriptive results showed a need to develop better education and medical–dental collaboration in the management of oral health in CKD patients. Indeed, large deficiencies in physician knowledge regarding oral diseases, especially those related to systemic conditions such as CKD, were noted. The authors suggested including oral health education into the medical curriculum and further enhancement through continuous professional development [16]. Rebolledo et al. examined oral health in patients with chronic kidney failure undergoing hemodialysis following the application of a stomatological protocol [17]. Their work, again, highlighted the potential beneficial interactive effects of focused oral health intervention in CKD patients. The study demonstrated improvement in oral hygiene indices and reductions in periodontal inflammation following initiation of a structured oral care protocol [17]. This underlines the need for oral healthcare as part of an overall strategy for the management of CKD patients.

Lu recently presented an overview of oral candidiasis at the pathophysiology, diagnosis, and management levels [18]. This work is very relevant to understanding and addressing fungal infections in immunocompromised CKD patients. Various forms of oral candidiasis, such as pseudomembranous, erythematous, and chronic hyperplastic types, were discussed. Diagnosis and treatment of this disease should be done taking into consideration the possibility of systemic spread in immunocompromised conditions [18]. The study of Summers et al. reported the association between renal disease and oral health and pressed into service the complex relationship between renal failure and oral manifestations, necessitating a multidisciplinary approach in handling oral health management in the patient with CKD. In this paper, they discussed oral manifestations or complications associated with CKD and its therapy, such as the gingival overgrowth related to immunosuppressive therapy. [19]. They emphasized the collaborative work between nephrologists and dental professionals for the comprehensive care of CKD patients.

Summary

While evidence piles high on the importance of oral health in CKD, the attention to oral health care generally raises concern, particularly in developing countries where there is a rapidly increasing burden of renal diseases. Therefore, it is important to understand the nature and prevalence of oral manifestations and their impact in CKD patients to allow contextualization of such issues in the UAE setting and then outline targeted interventions in caring for patients with CKD in general. A great improvement has been observed in CKD management lately, but the specific oral health needs have not yet been well researched or tackled for these patients in the UAE context. There is, therefore, an obvious necessity that UAE-specific research on oral manifestations among CKD patients be conducted. It will determine the prevalence and nature of oral lesions in patients with CKD in UAE, with the relation to progression in CKD stages and the evaluation of the knowledge, attitudes, and practices of patients and health providers regarding oral healthcare considerations in patients with CKD, implementing a developed and pretested care bundle aimed at enhancing oral care delivery to CKD patients in UAE. The present study addressed these gaps in knowledge and aimed to contribute to improved oral healthcare management of CKD patients in the UAE healthcare system.

Methodology

The present chapter describes the research method used to study the oral manifestations of chronic kidney disease in patients on hemodialysis in the UAE. It will include discussions on the research design, population and sample, sampling techniques, and the data collection and data analysis techniques that were utilized, as well as ethical considerations.

Research design

For this study, a cross-sectional observational research design that involved both qualitative and quantitative data collection tools

were used. This design enabled the collection of detailed information on the status of the oral health, the experiences and perception of the patients at a particular point [21]. In this study, both quantitative and qualitative approaches were used in an effort to gain broader and more extensive information regarding the oral symptoms of CKD in the HD patients. The use of both quantitative and qualitative data collection and analysis allowed not only finding out the extent of various oral health problems, but also the experiences of the participants with oral manifestations.

Study setting

The study was conducted in four EHS hospitals in the UAE: Saif bin Ghobash Hospital in Abu Dhabi, Fujairah Hospital, Khorffakan Hospital in Sharjah, and Dibba Hospital in Fujairah. The multicenter approach included the selection of different emirates and settings, to enhance likely generalizability of the resultant conclusions. In addition, these hospitals were chosen as they are among the highest volume providers of hemodialysis services in the UAE and serve a variety of patients from different parts of the country.

Study population and sampling

The target population was adult CKD patients who were undergoing hemodialysis at any of the hospitals in the UAE for at least one year. The sample size of 100 patients was determined based on the prevalence rates of oral manifestations in previous similar studies using statistical power analysis. Hemodialysis units of the participating hospitals used a method of systematic random sampling. They invited every third patient to participate until reaching the sample size needed.

Inclusion criteria for the participants were an age of at least 18 years old, diagnosed with CKD, and having undergone regular hemodialysis for a minimum of one year, agreeing to give informed consent, and the subject should be a non-smoker or a person who quit smoking five years ago. Exclusion criteria included patients younger than 18 years old, patients that underwent kidney transplantation within the last year, current smokers or who stopped smoking within the last two years, patients treated with chemotherapy or radiotherapy, and women in the pregnant stage, including patients with severe impairment in mental status.

Data collection methods

Data for this study were collected using a questionnaire survey, clinical oral examination, and a review of medical records. The structured questionnaire had recorded demographic characteristics, medical history, oral hygiene practices, perception of oral health problems, and barriers to dental care. The questionnaire was written in both English and Arabic and was piloted for validity and reliability. Oral mucosa assessments and periodontal evaluations assessed through the Community Periodontal Index (CPI) [21]. Xerostomia screening was done. Oral swab samples were taken for Candida assessment. With the consent of the patient himself [22], the medical record was obtained from hospital record units, which contain information regarding the period of diagnosis of patient's CKD, the period of hemodialysis treatment, and other treatment so far, recent laboratory tests, current medication, and comorbid problems.

Data analysis

The quantitative datasets were analyzed using the Statistical Package for Social Sciences, version 27.0. Descriptive statistics were used to characterize variables in the sample, providing prevalence statistics of oral manifestations. The association between the categories of predictors was analyzed through the chi-square tests. This enabled the researchers to show the general outline of the study population and distribute the frequency of oral health issues among hemodialysis patients diagnosed with CKD [23]. The qualitative data from the open-ended responses was analyzed thematically to look out for the emergent recurring patterns and themes. Qualitative analysis in the study complemented the quantitative findings [24]. This made it possible to account for feelings, perceptions, and experiences by the respondents on oral health matters.

Ethical Considerations

All the necessary approvals for this research from the Ethics and Research Committee of the Ministry of Health and Prevention, as well as from each of the individual participating hospitals, were secured. These were important in ensuring that this research complied with all the specific ethical considerations and regulations prescribed for medical studies in the UAE [23]. All the participants provided their informed consent, and the study maintained their confidentiality. Here, obtaining informed consent was necessary so that respondents would feel free to participate on their own terms in full knowledge of the purpose and procedures of the study. Data collected were deidentified, safely stored, and only used for the purpose of the study to secure privacy and maintain confidentiality [22]. All these were noted ethical considerations of an observer to assure the integrity of the research and the rights of the people under study.

Quality Assurance

To ensure that the data came up to such quality and consistency

as required, the researchers took a couple of measures, among which numbered standardized protocols in all the examinations and data collection procedures for equal execution and lower variability, examiner calibration exercises confirmed that time of dentists taking oral examinations were all acting on the same wave, and, finally, systematic checking for quality data kept inconsistency and error at the lowest possible minimums. The study followed the principles of Good Clinical Practice and the design of the study adhered to ethical and scientific research [21,24].

Summary

The presented study embraced a cross-sectional observational design with a mixed-methods approach study to investigate oral manifestations of CKD in hemodialysis patients in the UAE. The research was conducted in four hospitals, and data collection used questionnaire surveys, clinical oral examinations, and a review of medical records. Data obtained were subjected to adequate statistical methods and thematic analyses for both quantitative and qualitative data, respectively. This acted as enough information on the oral status and experiences of the participants in the study.

Findings

The present study sought to identify the prevalence and nature of oral lesions in patients with CKD on hemodialysis for one year or more in the UAE. To this end, study data was collected using questionnaire survey, clinical oral examinations, and medical record reviews from a total of 100 participants were recruited from Saif bin Ghobash Hospital in Abu Dhabi, Fujairah Hospital, Khorffakan Hospital in Sharjah, and Dibba Hospital in Fujairah. Key findings from this investigation for each of the main research objectives are outlined below.

To determine the prevalence of oral lesions related to CKD.

As show in Table 1, out of the 100 patients investigated, 74 (73.3%) had oral lesions while 26 (25.7%) had no symptoms of oral lesions.

Oral Lesions Prevalence					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	OL Symptoms	74	73.3	74.0	74.0
	No OL Symptoms	26	25.7	26.0	100.0
	Total	100	99.0	100.0	
Missing	System	1	1.0		
Total		101	100.0		

Table 1: Showing the prevalence of oral lesions.

To determine the most common signs and symptoms of oral manifestations of CKD by comparing their prevalence.

The data revealed that the most prevalent oral lesions among

Symptom	Prevalence
Oral pigmentation	4.0%
Dry mouth	40.0%
halitosis	17.0%
taste changes	23.0%
Burning sensation	12.0%
Periodontal changes	54.0%
Mucosal pallor	23.0%
Ecchymosis	8.0%
Petechiae	1.0%
gingivitis	5.0%
geographic tongue	5.0%
fissured tongue	2.0%
swelling	1.0%

Table 2

the study participants were periodontal changes, with a prevalence of 54.0%, followed by dry mouth with a prevalence of 40.0%. The next most prevalent oral manifestations were taste changes, reported by 23.0% of the patients, and mucosal pallor, observed in 23.0% of the participants. Symptoms related to salivary gland dysfunction were shown to be major concerns for a significant portion of the study participants given that 40% and 17.0% of them reported experiencing dry mouth (xerostomia) and burning sensation respectively. The symptoms with the lowest prevalence are swelling and Petechiae with only 1.0% of those studied having them, followed by fissured tongue with a prevalence of 2.0%.

Assess the relationship between oral lesions and gender and age.

Out of the 56 female patients investigated, 43 had oral lesions symptoms, representing a percentage of 76.8%. For the male patients studied, 31 out of 44 had oral lesions symptoms, representing a percentage of 70.5% (see Table 3). In terms of gender, therefore, the data showed that oral lesions were more prevalent among patients of the female gender.

However, as shown in Table 4, a chi-square test value of 0.513 was obtained with a corresponding p-value of 0.474 on further

Oral Lesions Prevalence				Total
OL Symptoms			No OL Symptoms	
Gender	Male	31	13	44
	Female	43	13	56
Total		74	26	100

Table 3: Prevalence of oral lesions relative to gender.

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig.(2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.513[a]	1	.474		
Continuity Correction[b]	.237	1	.626		
Likelihood Ratio	.511	1	.475		
Fisher's Exact Test				.499	.312
Linear-by-Linear Association	.508	1	.476		
N of Valid Cases	100				

Table 4: Chi-Square tests on the prevalence relative to gender.

analysis. This p-value is far much greater than 0.05, indicating that the relationship between oral lesions prevalence and gender is not statistically significant.

As shown in Table 5, the largest number of the respondents were between 70-79 years. Out of the 24 respondents in this age group, 21 had symptoms of oral lesions while 3 did not have. Again, all of

		Oral Lessions Prevalence		
		OL Symptoms Count	No OL Symptoms	
		Count	% with OL	
Age	20-29	3	0	100%
	30-39	7	8	46.7%
	40-49	10	3	76.9%
	50-59	12	5	70.6%
	60-69	16	7	69.6%
	70-79	21	3	87.5%
	80-89	5	0	100%

Table 5: Prevalence of oral lesions relative to age.

the 3 (100%) patients between 20-29 years had symptoms of oral lesions. This is also the case for patients between 80-89 years with 100% (n = 5) of those investigated presenting with symptoms of oral lesions. The group of those between 30-39 had more patients without oral lesions than those with the condition (8 v. 7).

To determine with the observed relationships between age and prevalence of oral lesions were statistically significant or by chance, a chi-square test was conducted. A chi-square test value of 56.298 is obtained with a corresponding p-value of 0.19 (see Table 6). This p-value was greater than the typical p-value threshold for

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	56.298[a]	48	.192
Likelihood Ratio	66.122	48	.042
Linear-by-Linear Association	.067	1	.795
N of Valid Cases	100		

Table 6: Chi-Square tests on the prevalence relative to age.

qualifying statistical significance (0.05), indicating that the relationship between oral lesions prevalence and age was not statistically significant.

Discussion

The present study aimed to investigate the prevalence and nature of oral manifestations in patients with chronic kidney disease (CKD) undergoing hemodialysis in the United Arab Emirates (UAE). The key findings from this research provide valuable insights into the oral health challenges faced by this patient population in the UAE context.

Prevalence of oral lesions

Likewise, 73.3% of CKD patients under hemodialysis also showed such lesions. This high prevalence was in keeping with most reports in the literature where a high prevalence rate of oral health problems among CKD patients was documented. For example, previous research has should that it was not uncommon for up to 90% of CKD patients to report at least one oral manifestation [9]. In the same breath, a study conducted in India by Asha et al. reported 76.7% of oral lesions in CKD patients on hemodialysis [8]. Consequently, the prevalence that the current study has outlined is high and indicates the enormous oral health challenges that CKD patients in the UAE still have, in line with trends reported elsewhere across the globe. This testifies to the multilevel game of renal dysfunction, systemic inflammation, and an impaired immune response and explains the high prevalence of oral manifestations in the majority of CKD patients. Actually, the hallmark feature of CKD is uremia, which leads to direct modifications to salivary composition, promotes the growth of opportunistic microorganisms, impairs wound healing, and finally has negative implications on oral health [12]. One of the important problems is a change in saliva composition, potentially influencing its functional properties. Moreover, the administration of different medications, including immunosuppressants and diuretics, to patients with CKD at the advanced stage may further aggravate oropharyngeal complications [9]. The present study results have accordingly identified the key importance of having comprehensive oral health appraisal and related management provided within holistic care and treatment of patients with CKD based in UAE.

The high prevalence of oral lesions in this study is a serious concern, as it might have serious consequences on the general health and well-being of CKD patients with poor oral health. Chronic inflammation-driven, untreated oral lesions lead to poor nutrition due to difficulties in eating and increased susceptibility to infections, thus further complicating the management of CKD, including impact on kidney transplantation surgery [7]. Moreover, oral-pathological burdens may remove a very significant factor in the reduction of quality of life of CKD patients, associated with pain or discomfort or burden from many psychosocial factors [10]. Results underscore the need for developing systematic and comprehensive oral healthcare assessment and treatment into care for CKD patients in the UAE. This should be a collaborative effort whereby, among others, the nephrologists and dental professionals are working together toward ensuring that the oral health needs of this group of patients are systematically identified and taken care of. Therefore, by giving emphasis to oral health within the CKD management paradigm, healthcare providers in the UAE could potentially reduce the ill effects of bad oral health and can increase the overall outcome of patients.

Common oral manifestations

The study identified the most prevalent oral lesions among the CKD patients, with periodontal changes (54.0%), dry mouth (40.0%), taste changes (23.0%), and mucosal pallor (23.0%) be-

ing the most commonly reported issues. These findings align with the existing body of literature on the oral health of CKD patients. The high prevalence of periodontal changes observed in this study is consistent with previous reports highlighting the increased risk of periodontal disease in CKD patients. Craig [12] and Sharma et al. [5] have extensively discussed the bidirectional relationship between CKD and periodontal disease, where the chronic inflammatory state associated with CKD can exacerbate periodontal conditions, and periodontal infections, in turn, can worsen kidney function through systemic inflammation and bacteremia. The increased susceptibility to periodontal disease in CKD patients is multifactorial, involving altered immune responses, metabolic disturbances, and the side effects of medications [12]. The observed high frequency of periodontal changes in the current study therefore necessitates improved periodontal assessment, preventive measures, and specific dental care for patients with CKD in the UAE.

The high levels of dry mouth or xerostomia found in this study are also evidenced in other studies. Mainali and Chettri identified that 68% of patients receiving hemodialysis expressed xerostomia which however negatively affected their quality of life [10]. Xerostomia is the most common oral complication among CKD patients, as it may result from fluid limitations, adverse effects of medications, or changes to the salivary glands [9]. These factors are in addition to the reduced saliva secretion rate and alterations in the composition of saliva that can lead CKD patients to develop various oral health issues like caries, periodontal disease and oral infections. The high level of xerostomia recorded in the present study points toward the need to implement salivary gland protective measures like substitution with saliva, stimulation of saliva, and enhanced oral hygiene among the patients.

Other findings on oral manifestations included taste changes that were reported by 23% of the participants. Afroozi., *et al*. also investigated the prevalence of taste disturbances in hemodialysis patients in Iran and noted a 35% prevalence [9]. Taste alterations in patients with CKD have been attributed to the accumulation of solutes, zinc deficiency, and side effects from medicine [11]. These taste changes can affect nutrient consumption and nutritional status, which complicates the health concerns of CKD sufferers. The findings on taste changes in this study suggest the importance of routine assessment and intervention for this condition with the implementation of nutritional counseling and taste improvement approaches to promote better nutritional health among CKD patients in the UAE.

Another manifestation that the study observed in the participants was mucosal pallor which was present in 23% of the participants. Mucosal pallor is one of the symptoms of CKD and anemia is also one of the complications of CKD. Kuravatti., *et al*. [15] and Sunil., *et al*. [14] have described the various nonspecific oral mucosal lesions, which can occur in patients with CKD, such as uremic stomatitis, angular cheilitis and lichenoid reaction. These mucosal changes should be identified and treated at an early stage in order to avoid complications as well as improve patients' comfort. The prevalence of mucosal lesions in the current study also strengthens the call for thorough extra- oral examinations and the inclusion of dental professionals in the management of CKD patients to promptly diagnose and treat these severe oral complications.

Relationship with gender and age

The present study sought to identify possible correlations with oral lesions and patient characteristics, with reference made to gender and age of the patients. According to the obtained data, the frequency of oral lesions in female subjects (76. 8%) was higher than in males (70. 5%), though to reach significance the difference did not reach the set level. This recommendation presents a difference with some of the prior studies that have established gender disparities in prevalence of the manifestations in CKD patients. For example, Asha et al. established that the CKD female patients had significantly higher prevalence of the oral lesions than the male counterparts [8]. The lack of a statistically significant association between gender and oral lesions in the current study may be influenced by factors such as sample size, cultural norms, and healthcare-seeking behaviors in the UAE context. This necessitates further research to examine possible influence of these factors.

Concerning age and prevalence, examinations indicated that the oldest groups had a prevalence rate of 100 percent for the 20-29 years and 80-89 years-old groups. Generally, though, age did not have any relevance in relation to oral lesions. This contrasts somewhat with some earlier studies that have reported a correlation of increasing age to a higher burden of oral health problems in CKD patients [9]. There may be numerous factors for the non-significant association observed in the present study, which may include the sampling distribution across age groups, specific oral manifestations studied, and general health status of participants. The duration and stage of CKD, the presence of comorbidities, and use of medications may all bear a more meaningful relationship with oral lesion formation in this population. That there were no statistically significant relationships between oral lesions and gender, age in the present research suggests that variables linked with

the disease process, its treatment, and the healthcare system, and not demographic characteristics, are more strongly predictive of oral health challenges among CKD patients in UAE. That calls for the incorporation of a holistic, patient-centered approach into oral health management in patients with CKD, considering the multifaceted factors affecting oral health status.

Implications for clinical practice and policy

This study has several key implications for clinical management and policy considerations of oral health among patients with CKD within the UAE healthcare system. First, the high prevalence of oral lesions recorded in this study underlines the critical need to integrate comprehensive oral health assessments and care into routine management for CKD patients. Oral health in the care of CKD patients is currently a highly underestimated factor, more so in developing countries like UAE, where the particular oral health needs of this population are not well explored or managed [3]. This paper gives impetus to set up collaborative models of care between nephrologists and dental professionals for ensuring that the oral health needs of CKD patients are diligently identified and properly managed.

Therefore, it places a call for developing and implementing oral health education and promotion programs targeting CKD patients, their caregivers, and health care providers in the UAE. According to a study carried out by Sarumathi et al., there were large gaps in physicians' knowledge about oral diseases and their relationship to such systemic conditions as CKD [16]. These gaps in knowledge could then be subsequently filled by continuing education initiatives and may include oral health content in medical curricula. This would ensure that all healthcare providers are qualified to identify and deal with oral health issues, thereby improving the overall management of patients with CKD. Thirdly, the lessons learnt through this study could contribute to meaningful input on designing or modifying local oral health care protocols, or even appropriate interventions amongst patients with CKD in the UAE healthcare system. The results from Rebolledo et al. demonstrated that structured oral care protocols in CKD could be associated with an improvement in oral hygiene and the reduction of periodontal inflammation [17]. With the knowledge of the specific oral-health challenges identified from this study, health providers within the context of the UAE could design and pilot test customized oral-health interventions that address unique needs of CKD patients.

Its results can also apply to the development of evidence-based policies and guidelines for managing oral health in CKD patients in the UAE. This research will therefore clarify both the prevalence and nature of oral lesions observed in this group of patients, hence allowing policy makers and health authorities to set a standard of care, allocate proper resources, and make provisions for the inclusion of oral health in the overall management of CKD in the UAE. This could involve the formulation of clinic practice guidelines in the incorporation of oral health assessments into routine care for CKD, accessible and affordable dental services for these patients, and so on. Lastly, a deeper understanding from the findings of this study can aid in building upon future studies and enable cross-cultural comparison within the literature about oral health and CKD. These results in UAE-specific data can create a baseline against which future comparisons could be made, for targeted interventions, and collaboration with other countries facing similar challenges attending to the oral health needs of CKD patients. By conducting this preliminary study, the scientific community will further cement a better understanding of the complex relationship between kidney disease and oral health, improving quality of life and clinical outcomes for CKD patients within the UAE and beyond.

Conclusion

The present study sought to explore the prevalence and nature of oral manifestations among hemodialysis patients with CKD in the UAE. Its major findings, arising from its investigation, shed much-needed light on the wide-ranging problems in oral health concerning this specific category of patients within a local UAE context. The present study showed a very high prevalence of different oral lesions in patients with CKD, out of which periodontal changes, dry mouth, taste changes, and mucosal pallor were the most prevalent complaints. These findings are consistent with available literature on the oral health complications affecting individuals with CKD and further afford emphasis on the need to give greater importance to the oral health of the said patient population. However, oral lesions did not have any statistically significant associations with patient demographics, like gender and age. This would probably mean that the challenges to oral health among CKD patients in the UAE are much more influenced by factors relating to process of disease, treatment, and healthcare system than by demographic characteristics alone. This underscores the need for a holistic, patient-centered approach in oral health management among this patient population, as their oral health status can be multifactorial.

Several key implications for clinical practice and policy can be derived directly from the results of this study within the UAE healthcare system: firstly, the high prevalence of oral lesions demands the integration of comprehensive oral health assessments and care into the routine management of CKD patients. It would have to establish models of collaborative care among nephrologists and dental professionals in order to assure the systematic identification and so satisfy the oral health needs of CKD patients. This is followed by the

development and implementation, according to the results of this study, of guided oral health education and promotion programs amongst CKD patients and their caregivers as well as their healthcare providers within the UAE. It may be able to raise awareness of knowledge gaps such that oral health in the management of CKD could become a developed area of importance for overall care and better outcomes in this patient population.

The findings from the research will further enlighten ways in which oral health care protocols are developed, pointedly tailored to CKD patients within the UAE healthcare setting, using insightful oral health challenges identified in the current investigation. Aside from the above, study findings can be applied in the development of evidence-based policies and guidelines for oral health management in CKD patients, including oral health in the comprehensive care of these patients.

Finally, data generated from this study can be used as a baseline or referential point for further studies and cross-cultural comparison about oral health and CKD. The UAE, specific data provided by the study can be used as base line for establishing benchmarks and even pinpoint pocket area where focused intervention is necessary. It can also open up the opportunities for the author to collaborate with other countries who are experiencing similar challenges that hinder the provision of appropriate and competent care of CKD patients' oral health.

While some valuable insights can be drawn from the current study, it is not without its limitations. The cross-sectional design of the study provides a snapshot of the oral condition at only one point in time, hence did not examine causal links. Also, the study population was strictly based on CKD patients undergoing hemodialysis. Therefore, it might not represent the oral health profiles for people at different stages of CKD or receiving some other modality of renal replacement therapy. Such studies in the future should consider applying a longitudinal study design to more clearly elucidate trajectories of oral health issues in their relationship with CKD progression and overall patient outcomes. Expanding the study population to include a broader spectrum of CKD patients, as well as incorporating the potential influence of specific comorbidities, medication regimens, and socioeconomic factors, could provide a more comprehensive understanding of the determinants of oral health in this patient population.

Acknowledgment

Acknowledgment to Emirates Health Services

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