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STRUCTURE AND PREVALENCE OF DENTAL DISEASES IN PATIENTS WITH EARLY STAGES OF CHRONIC KIDNEY DISEASE IN AZERBAIJAN

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The purpose of the study was to investigate the features of dental diseases and their distribution in patients with early stages of chronic kidney disease in Azerbaijan. The study involved 179 patients with early stages of chronic kidney disease. Decayed, Missing due to caries, Filled Teeth index, Caries, Fillings and Extractions index, Müllemann bleeding index, Svrakov iodine index, Community Periodontal Index and Gingival Index, Fuchs and Rumford indices were measured. The results showed that in patients with chronic kidney disease generalized periodontitis was present in 81.8 % of cases, and localized periodontitis in 18.2 % of cases, which is 5.4 and 1.7 times more than in the control group, respectively. In the early stages of chronic kidney disease, the prevalence of periodontitis is higher than caries and chronic periodontal diseases. An increase in the DMFT index was observed as kidney function decreased. Fuchs and Svrakov iodine indices were different during chronic kidney disease compared to the control group ($p<0.01$).

Key words: chronic kidney disease, periodontitis, caries, Decayed, Missing due to caries, Filled Teeth index, Svrakov iodine index, gingival index.

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СТРУКТУРА І ПОШИРЕНІСТЬ СТОМАТОЛОГІЧНИХ ЗАХВОРЮВАНЬ У ХВОРИХ ІЗ РАННІМИ СТАДІЯМИ ХРОНІЧНОЇ ХВОРОБИ НИРОК В АЗЕРБАЙДЖАНІ

Метою дослідження було вивчення особливостей стоматологічних захворювань та їхнього поширення у хворих із ранніми стадіями хронічної хвороби нирок в Азербайджані. У дослідженні взяли участь 179 пацієнтів із ранніми стадіями хронічної хвороби нирок. Було виміряно індекс «Decayed, Missing due to caries, Filled Teeth index», індекс «Caries, Fillings and Extractions index», індекс кровотечі Мюллеманна, йодний індекс Свракова, пародонтальний індекс спільноти і ясенний індекс, індекси Фукса і Рамфорда. Результати засвідчили, що у пацієнтів із хронічною хворобою нирок генералізований пародонтит був присутній у 81,8 % випадків, а локалізований пародонтит – у 18,2 % випадків, що в 5,4 і 1,7 раза більше, ніж у контрольній групі відповідно. На ранніх стадіях хронічної хвороби нирок поширеність пародонтиту вища, ніж карієсу і хронічних захворювань пародонту. Збільшення індексу DMFT спостерігалося в міру зниження функції нирок. Індекси Фукса і Свракова за хронічної хвороби нирок відрізнялися порівняно з контрольною групою ($p<0,01$).

Ключові слова: хронічна хвороба нирок, пародонтит, карієс, індекс DMFT, йодний індекс Свракова, ясенний індекс.

Chronic kidney disease (CKD) is considered one of the major public health problems of our time [5]. Various forms of oral diseases are observed in 82 % of patients with CKD [6]. Among these diseases, the most common oral diseases are periodontitis and gingivitis. Patients with CKD undergoing hemodialysis are more susceptible to severe periodontal diseases [1].

The increasing number of people suffering from this disease and the limited research in this area require special attention to the study of oral manifestations associated with chronic kidney disease. Chronic kidney disease, like other systemic diseases, is associated with oral problems as a result of the pathogenesis of the disease or the therapy used, or both. The role of inflammatory factors in the progression of chronic kidney disease has been demonstrated, and periodontal lesions found in this group of patients have been associated with chronic oral inflammation [9, 11].

According to some studies, oral hygiene and chronic kidney disease are associated. Thus, in some studies, maintaining oral hygiene reduced the risk of developing chronic kidney disease [2]. In general,

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patients with chronic kidney disease are less likely to seek dental care compared to the healthy population, since the main treatment is aimed at maintaining kidney health [4]. Periodontal diseases are also common in patients receiving peritoneal dialysis, and the presence of periodontitis affects their systemic inflammatory status [3]. Another study also found an association between the prevalence of apical periodontitis and patients with end-stage renal disease [7].

Many studies have focused on patients with uremia and patients receiving renal replacement therapy (hemodialysis, peritoneal dialysis, kidney transplantation) [10]. There are no studies examining the prevalence and clinical characteristics of dental diseases in the early stages of chronic kidney disease.

The purpose of the study was to investigate the features of dental diseases and their distribution in patients with early stages of chronic kidney disease in Azerbaijan.

Materials and methods. The study involved 179 patients with early stages of CKD who were treated at the Educational and Therapeutic Clinic of the Azerbaijan Medical University from January 2021 to September 2023.

Among them, only patients with CKD stages 1 and 2, whose diagnosis was confirmed by a nephrologist according to the KDIGO 2024 protocol, were included in the study [8]. The study did not include patients under 22 years of age, over 65 years of age, with estimated glomerular filtration rate [eGFR]<60 ml/min/1.73 m2, as well as patients with other somatic pathologies. For comparison, the control group consisted of 100 people without somatic diseases. The oral hygiene status of all patients was assessed using the Fedorov-Volodkina and Green-Vermillion hygiene indices, as well as the oral hygiene index (OHI-S – Simplified Oral Hygiene Index). The assessment was carried out on the following scales: 0–1 – satisfactory oral hygiene, 1.1–2 – adequate oral hygiene, 2.1–3 – unsatisfactory oral hygiene.

DMFT index (D (Decayed), M (Missing) due to caries, and F (Filled)) and CFE (Caries, Fillings and Extractions) index was used to assess the condition of the teeth. The periodontal condition was assessed using the Müllemann bleeding index, Svrakov iodine index, CPI (Community Periodontal Index) index and GI (Gingival Index), Fuchs and Rumford indices.

Müllemann bleeding index, also is known as Sulcus Bleeding Index, developed by Mühlemann, assesses gingival inflammation and bleeding on probing. Bleeding on probing is scored on a scale of 0 to 5, with 0 indicating no bleeding and 5 indicating spontaneous bleeding, color change, and marked edema. This index uses a periodontal probe to examine four gingival units for each tooth.

The Svrakov iodine index (Svrakov iodine number) was used to determine inflammation. It is based on the treatment of the oral mucosa with iodine-iodine-potassium solution. Staining occurs in areas where there is deep damage to the connective tissue. It is associated with the accumulation of a large amount of glycogen in areas of inflammation. The test is quite sensitive and objective: when the inflammatory process subsides or stops, the intensity of the coloring and its area decrease.

Community Periodontal Index Assesses the presence or absence of gingival bleeding on probing, supra or subgingival calculus and periodontal pockets by using 0.5 mm ball tip WHO probe. The advantages include simplicity, speed and international uniformity.

Gingival Index is a method used to assess the condition of the gums by evaluating qualitative changes in the gingiva (the gum tissue around the teeth). It's a scoring system, with scores ranging from 0 to 3, that indicates the severity of gingivitis (gum inflammation).

The Rumford index is both a tooth- and site-specific index. This index uses a periodontal probe with markings at 3, 6, and 8 mm. The index score ranges from 0 to 6.

Statistical processing and graphical representation of the factual material was carried out using the “SPSS” software (version: 28.0). The following parameters were calculated: mean (M), standard deviation (SD), minimal and maximal values (min–max), and the reliability of the obtained data was assessed using the t-test (Student's test).Correlation analysis was applied to determine the relationships between different indicators. Results were considered significant when $p<0.05$.

Results of the study and their discussion. Based on the results of the examinations, the mean age of patients was 49.3±14.34 (24–66) years. Among them, 86 (48 %) were female, 93 (52 %) were male. The mean duration of the disease was 6.54±1.14 years (0.25–17.58).

67 (37.4 %) patients use cigarettes, the others (112; 62.6 %) were non-smokers.

DMFT index was higher in female patients than in male patients ($p=0.007$). A significant negative correlation was observed between eGFR and DMFT index ($r=-0.421$; $p=0.014$).

Also, DMFT index was significantly higher in current or former cigarette users (25.41±6.49) compared to non-smokers (14.78±8.93) ($p<0.023$). DMFT indicators were determined in CKD patients and the results were as following: number of teeth with caries – 6.74±2.34 (3.00–14.00); number of extracted

teeth–14.18±6.71 (2.00–21.00); number of filled teeth – 3.19±2.47 (0.00–9.00) and CFE index – 20.08±9.63 (1.00–31.00).

Among all clinical manifestations, gingival bleeding was the most common oral disease finding (71.2 %). Lost teeth due to caries were the second most common finding (45.6 %). Carious teeth were the third most common finding (42.4 %). These findings were significantly higher in CKD patients than in the control group.

In accordance with the purpose of the study, a comparative analysis of patients with chronic kidney disease and healthy individuals showed that the prevalence of dental caries and its complications in the studied group of patients with chronic kidney disease was the highest among other diseases, at 61.5 %. It should be noted that periodontitis was 1.77 times more common in the studied group. Caries was 1.17 times higher in patients with chronic kidney disease, periodontitis 1.59 times higher, and non-carious disease of the hard tissues of the teeth 1.3 times higher in patients with chronic kidney disease than in those without somatic disease. In addition, secondary recurrent caries was detected in 19 patients (10.6 %).

Stomatological Analysis of the prevalence of the main dental diseases in patients with chronic kidney disease and individuals without somatic disease is shown in Table 1.

Table 1

Prevalence of major dental diseases in patients with chronic kidney disease

Common dental diseases	Patients in the early stages of CKD, n=179		Without somatic disease, n=150		Honesty factor p
	Absolutely	%	Absolutely	%	
Parodontitis	110	61.5	62	41.3	<0.001
Gingivitis	43	24.0	51	34.0	<0.05
Caries	162	90.5	138	92.0	>0.05
Pulpitis	33	18.4	36	24.0	<0.01
Periodontitis	27	15.1	14	9.3	<0.01
Mucous membrane diseases	16	8.9	5	3.3	<0.01
Non-carious disease of the hard tissue of the tooth	17	16.2	13	6.7	<0.01

In the control group, the incidence of alveolar osteitis and pulpitis was 1.18 and 1.09 times higher than in patients with CKD, respectively. In CKD patients, chronic pulpitis prevailed, with 28 patients out of 33 pulpitis patients. Among those without somatic diseases, chronic and acute pulpitis were 30 and 6, respectively. In total, 11 patients with acute pulpitis were provided with emergency dental care. In CKD patients, chronic fibrous pulpitis prevailed - in 18 patients (64.2 %); gangrenous pulpitis was diagnosed in 8 patients (28.8 %); hypertrophic pulpitis was identified in only 2 patients.

Non-carious changes in the hard tissues of the teeth were detected in 16.2 % of patients with CKD, which is 1.23 times more than in patients in the control group.

Some of the most common dental diseases in CKD patients are illustrated with descriptive pictures (Fig. 1).

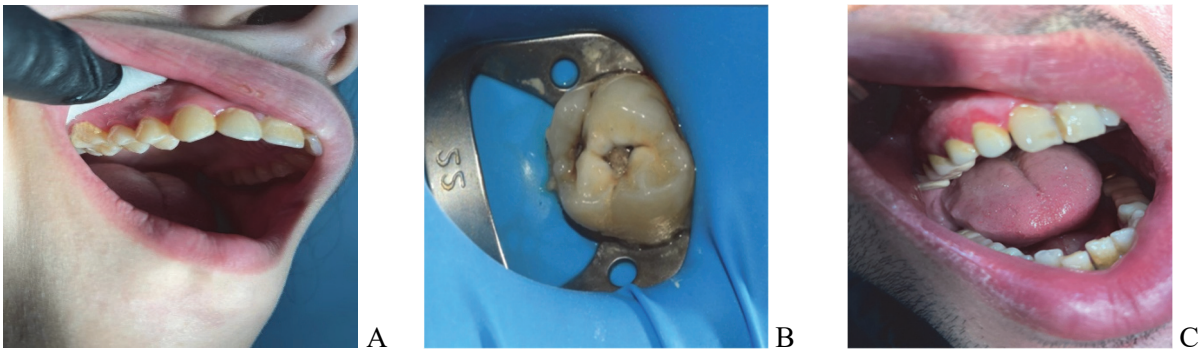

Fig. 1. The most common dental diseases in patients in the early stages of CKD: A – Periodontitis; B – Caries; C – Gingivitis.

As we have noted, the prevalence of chronic inflammatory periodontal diseases was high in patients with CKD. Generalized periodontitis was present in 81.8 % of cases, and localized periodontitis in 18.2 % of cases, which is 5.4 and 1.7 times more than in the control group, respectively.

Regarding the assessment of periodontal status, tartar was detected in 76 patients (42.5 %) in CKD patients, and periodontal pockets were observed in 41.8 % of patients. It should be noted that high tartar was detected in 16 out of 37 patients with satisfactory oral hygiene. At the same time, the study showed

that 21.9 % of 73 patients with unsatisfactory oral hygiene had periodontal pocket depth ≥6 mm (Table 2).

Table 2

Concordance analysis between CPI and OHI-S in CKD patients

CPI					
OHI-S Index	Health	Bleeding	Dental plaque or dental calculus	Parodontal pocket 4–5 mm	Parodontal pocket ≥6mm
Satisfactory oral hygiene, N=37	3	8	16	6	5
Adequate oral hygiene, N=69	1	18	24	20	9
Unsatisfactory oral hygiene, N=73	–	13	36	19	16
Total	4	51	76	45	30

Among all clinical manifestations, dental plaque and tartar were the most common (42.5 %). Other periodontal indices were also evaluated in patients with CKD compared to those without somatic disease. Svarkov iodine index was 3.61±0.95 in patients with CKD (n=179), which is significantly differ compared to individuals without somatic disease (2.94±0.85); $p<0.01$. Gingival index were 1.27±0.78 in patients with CKD and 1.32±0.85 in comparison group (without somatic disease); $p>0.05$.

Müller bleeding index values in patients with CKD was 3.55±0.81, and 3.31±0.75 in persons without somatic disease, which was statistically insignificant ($p>0.05$). Ramfold index also did not showed significance in results between two groups (3.75±1.18 and 3.46±1.21; $p>0.05$). However, Fuchs index in compared groups demonstated significant differences (0.75±0.12 and 1.72±0.06, respectively; $p<0.01$)

Thus, when evaluating periodontal indices, it was found that the results of Fuchs and Svrakov iodine indices in patients with CKD compared to the control group showed a statistically significant difference ($p<0.01$).

There are several studies in the available literature that have shown a link between oral diseases and chronic kidney disease. These studies indicate that regular oral care may be an important strategy for reducing the burden of CKD.

Thus, Ausavarungnirun R, et al (2016), in order to evaluate the relationship between dental and periodontal diseases in Thai patients with different stages of CKD, examined 129 patients with different stages of CKD. They concluded that the severity of periodontal disease was associated with the severity of CKD (a direct relationship was observed in the degree of prevalence). The authors also found a relationship between serum albumin levels and periodontal status, which was showed at deep stages of CKD [1]. However, albumin levels were not assessed in our study, but we agree with the researchers that dental intervention may be useful at the early stages of CKD.

Ruokonen H, et al (2019) conducted a prospective follow-up cohort study to analyze oral symptoms in patients with chronic kidney disease. In addition, they also assessed health habits and oral health-related quality of life (OHRQoL). A total of fifty-three patients with CKD were included in the study and followed up for an average of 10.3 years. All assessments were performed at baseline and after transplantation. According to the results, OHRQoL identified patients with a high oral inflammation score, thereby confirming the hypothesis of a relationship between chronic kidney disease and oral health [11]. This coincides with our data, emphasizing the importance of timely dental intervention.

In one of the retrospective cohort studies conducted by the authors, which included 76 patients who underwent PD, a number of parameters were assessed, including the gingival index (GI), plaque index (PLI), probing depth (PPD) and clinical attachment loss (CAL). The authors correlated periodontal or clinical parameters with the incidence of complications associated with PD. All patients had periodontitis; PPD was inversely proportional to serum albumin; CAL has a positive correlation with serum C-reactive protein; PLI was positively correlated with serum calcium [3]. There was no correlation between periodontal parameters and CCE or poor prognosis.

We also assessed gingival index and some other indices, but did not evaluate correlations with serum inflammation indices, which may be the subject of future studies.

Conclusions

1. The prevalence of chronic inflammatory periodontal diseases was high in patients with CKD: generalized periodontitis was present in 81.8 % of cases, and localized periodontitis in 18.2 % of cases, which is 5.4 and 1.7 times more than in the control group, respectively.

2. When evaluating periodontal indices, it was found that the results of Fuchs and Svrakov iodine indices in patients with CKD compared to the control group showed a statistically significant difference ($p<0.01$).

The results showed that the prevalence of stomatological diseases among the CKD population is higher than that of those without somatic diseases. In the early stages of CKD, the prevalence of periodontitis is higher than caries and chronic periodontal diseases. Also, an increase in the DMFT index was observed as kidney function decreased. Treatment of stomatological diseases should be included in the treatment plan of CKD patients.

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