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The Assessment of Gingival Crevicular Fluid Microbiota in Patients With Chronic Kidney Disease

MEDICAL SCIENCE

KEYWORDS : Chronic periodontitis, chronic kidney disease, periodontal pathogens, polymerase chain reaction

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ABSTRACT

Introduction and aim: The periodontal disease may represent a risk factor in patients with chronic kidney disease; we proposed an evaluation of the periodontal pathogens in patients with periodontal disease, with and without chronic kidney disease. Methods: The periodontal status of the patients, divided in two groups (test group – with chronic kidney disease and a control group) was assessed and samples of gingival crevicular fluid were taken to detect the periodontal pathogens by polymerase chain reaction methods. Results: The red complex bacteria were more frequent in patients with chronic kidney disease. The local bacterial loading may exert severe systemic effects in patients with chronic kidney disease and the periodontal therapy could improve the prognosis in these patients. Conclusions: The high frequencies of aggressive periodontal pathogens and of severe forms of periodontal disease determine a rigorous approach in these patients, with frequent control visits.

INTRODUCTION

The chronic kidney disease (CKD) is a progressive and irreversible loss of the function and number of nephrons. This type of disease has multiple risk factors, the main ones considered to be diabetes mellitus, hypertension and obesity (Jha, Garcia-Garcia, Iseki, Li, Naicker, Plattner, Saran, Wang & Yang, 2013). The mechanisms of progression to an end stage of renal dysfunction may imply the glomerular hyper-filtration, high blood pressure with cytokine induction (especially, angiotensin II and the transformation of β-growth factor), proteinuria or renal ischemia (Iseki, 2005). The high susceptibility to infectious diseases of the CKD patient seems to be related to the immunodeficiency level associated to the uremic levels (Kato, Chmielewski, Honda, Pecoits-Filho, Matsuo & Yuzawa, 2008).

The hemodialysis and peritoneal hemodialysis treatment determine systemic changes, oral complications and changes of the saliva components (Precious, Laba & Hinrichsen, 1981). Moreover, the gastro-esophageal reflexes and a scarce oral hygiene could affect the oral health in patients with chronic hemodialysis [Avesalon (Sincar), Solomon, Rudnic, Martu & Martu, 2013]. The concentrations of salivary electrolytes could induce the calculus formation but they also enhance the enamel re-mineralization, leading to a decreased number of carious lesions in children (Pernu, Pernu, Huttunen, Nieminen & Knuuttila, 1992).

Chronic periodontitis represents an inflammatory disease, with a long-term evolution and with a very complex etiology, affecting the profound periodontal tissues. Cardiovascular diseases, diabetes mellitus, renal dysfunctions can be included in the vast group of systemic risk factors for periodontitis. Numerous studies proved that, due to its inflammatory characteristics, the relationship between periodontitis and the systemic diseases could also be seen as a "two-way street"; a localized inflammatory disease, such as chronic periodontitis, can affect the entire systemic status of the patient. On account of these facts, it was observed that the periodontal disease may represent a risk factor also for CKD (Fisher, Taylor, Shelton, Jamerson, Rahman & Ojo, 2008).

The bacteria from the sub-gingival biofilm release proteolytic enzymes which destroy the periodontal tissues. Furthermore, the local release of pro-inflammatory cytokines during the immune host response may negatively influence the systemic status. Socranski, Haffajee, Cugini, Smith and Kent (1998) divided the periodontal pathogens in complexes of microorganisms, the red complex presenting the highest association with periodontal tissues destruction. The literature data are contradictory; Castillo, Mesa, Liebana, Garcia-Martinez, Ruiz and Garcia-Valdecasas (2007) did not observe a significant association between the frequency of the periodontal pathogens and CKD.

Therefore, we proposed an evaluation of the periodontal pathogens in patients with CKD, when compared to systemic healthy subjects.

MATERIALS AND METHOD

The study was conducted on a number of 78 patients, divided in two groups: patients with periodontal disease and chronic kidney disease (n=38) and patients with periodontal disease, systemically healthy (n=40).

The inclusion criteria were: the presence of periodontal pockets with probing depths ≥5 mm in multiple sites (more than one tooth affected per dental arch).

The exclusion criteria were: smoking, periodontal treatment, antibiotics or anti-inflammatory drugs in the last 6 months, pregnancy, lactation.

The methodology of our study followed the international standard and the principles of the Helsinki Declaration. Every patient was informed regarding the nature of the study, a signed informed consent being obtained from every subject.

A rigorous clinical examination was conducted on every patient, including periodontal probing in six sites per tooth and the evaluation of periodontal indices (hygiene index, bleeding on probing index, CPITN). Following the clinical examination, associated with radiographic images, the periodontal diagnosis was established.

For the microbiologic examination we obtained samples of gingival crevicular fluid with sterile paper strips. After the iso-

lation, we slightly dried the site, the paper strip was inserted in the sulcus and maintained for 10 seconds. The strips were placed in sterile recipients. The identification of the pathogens was obtained by polymerase chain reaction (PCR) methods. The analysis of the pathogens was a qualitative one.

The obtained data were recorded and statistically analyzed. For this purpose we used Microsoft Excel and PASW Statistics 18 softwares.

RESULTS AND DISCUSSION

We examined a number of 78 patients divided in two groups: test (with CKD) and control (without CKD). The mean age for the test group was 57±2 years old and in the control group - 49±3 years old. The percentage of male subject in the test group was 45,4% and in the control group - 78,24%. The demographic data are presented in Table 1.

Table 1. Demographic data of the study groups

Parameter	Study group	Control group
Age (mean value±SD)	57±2 years	49±3 years
Gender (percentage)	Male: 45,4%	Male: 78,24%
	Female: 54,6%	Female: 21,73%
Environment (percentage)	Urban: 64,56%	Urban: 74,65%
	Rural: 35,44%	Rural: 25,35%

The mean value of present teeth was significantly different between the groups; the frequency of the sites with probing depths ≥ 5 mm was lower in the control group (Table 2). These aspects are suggestive for the presence of more severe forms of periodontitis in patients with CKD.

Table 2. Analysis of periodontal parameters

Parameter	Control group (mean±SD)	Study group (mean±SD)	P-value
Mean number of teeth	24±4,3	15±5,2	0,020
Sites with bacterial plaque (%)	28±1,4	64±1,1	0,001
Sites with bleeding on probing (%)	23±6,3	37±4,2	0,050
Mean Probing depth (mm)	2,6±0,6	3,4±1,5	0,050
Sites with probing depth>5mm	8,4±6,6	22,9±11,5	0,014

Table 3 presents the frequency of the microorganisms, evaluated by PCR methods. In the control group the most frequent pathogen was Eikenella corrodens, followed by Porphyromonas gingivalis, Prevotella nigrescens, Treponema denticola, Tannerella forsythia and Fusobacterium nucleatum. In this group we could not detect the presence of Aggregatibacter actinomycetemcomitans or Prevotella intermedia.

Table 3. The frequency of the periodontal pathogens in the study groups

Pathogen (%)	Control group	Study group	P-value
P.gingivalis T.forsythia	73,3 34,4	95,8 40,2	0,076 0,480
T.denticola	37,9	45,2	0,445
F.nucleatum	6,4	17,3	0,280
P.intermedia P.nigriscens	0 39	14,7 40,1	0,167 0,632
A.actinomycetemcomitans E.corrodens	0 95,8	5 96,9	0,579 0,694

In the test group the most frequent periodontal pathogen was still E.corrodens, followed by P.gingivalis, T.denticola, T.forsythia, P.nigriscens, F.nucleatum, P.intermedia and A.actinomycetemcomitans. Although the frequencies of these pathogens were higher in the test group, the significance level was obtained only for P.gingivalis, T.forsythia and T.denticola.

In the present study we observed a high level of association between the presence of periodontal pathogens from the red complex (P.gingivalis, T.forsythia and T.denticola) and the context of CKD, more significant when compared to the control group which included healthy subjects. The cellular and humoral anomalies and the phagocytic activity associated with the uremic level may explain the high frequency of aggressive periodontal pathogens in these patients.

Numerous studies presented correlations between the poor oral status and CKD [Davidovich, Schwarz, Davidovitch, Eidelman & Bimstein, 2005; Avesalon (Sincar), Solomon, Rudnic& Martu, 2012], when compared to healthy subjects. Moreover, an association between high levels of C reactive protein and periodontal disease in CKD patients was presented (Bastos, Vilela, Andrade, Diniz, Silva & Chaoubah, 2009).

Fisher et al. (2008) demonstrated that chronic periodontitis is an independent risk factor for CKD. In our study we observed that more severe forms of chronic periodontitis were exerted by CKD patients.

Chronic periodontitis determines the destruction of profound periodontal tissues, leading to dental loss. In our study, the lower number of present teeth in patients with CKD, maybe determined by more severe forms of periodontitis in these patients, is in concordance with the literature data (Kshirsagar, Moss, Elter, Beck, Offenbacher & Falk, 2005].

It is possible that the periodontal therapy could improve the prognosis in patients with CKD by reducing the inflammatory loading but this aspect necessitates further studies.

CONCLUSIONS

The red complex periodontal pathogens (P. gingivalis, T. forsythia, T. denticola) were more frequent in patients with chronic kidney disease when compared to the control group. Furthermore, the forms of chronic periodontitis were more severe in patients with renal impairment. These data emphasize the importance of frequent visits in the dental office in patients with CKD; therefore, these patients need to be included in a special maintenance program.

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