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Knowledge and attitudes of Brazilian dentists towards the dental treatment of chronic kidney disease patients

Abstract:

Chronic kidney disease (CKD) is characterized by metabolic alterations and progressive irreversible loss of the kidney's ability to perform glomerular filtration. Dental follow-up and handling of individuals with CKD is important and represents a challenge for the dentists. Thus, the aim was to assess the knowledge, attitudes, and practices of Brazilian dentists towards the dental treatment of CKD patients. This research employed a cross-sectional study conducted between June and September 2019, with 488 dentists, from São Paulo, SP, Brazil. Data collection occurred through application of a structured self-report form using Google Forms tool. The questions addressed clinical knowledge towards dental treatment of patients with CKD, during invasive or non-invasive dental procedures. Sociodemographic data were collected by using the same questionnaire. A descriptive analysis of the data, Chi-square and Linear Association tests were performed. A significant percentage of participants (223/488; 45.7%) felt uncomfortable performing invasive dental treatments in CKD patients. The great majority (385/488, 78.9%) would prescribe prophylactic antibiotics before invasive dental procedures, whereas 18.2% would prescribe antibiotics, even before non-invasive procedures. Most dentists recommended this practice to prevent colonization of the venous access for haemodialysis (225/448; 57.4%), and to prevent infective endocarditis (176/488; 44.9%). Female gender (268/385; 69.6%) and private higher education institution (250/385; 64.9%) were found to be associated with the prescription of prophylactic antibiotics in CKD individuals on haemodialysis ($p < 0.005$). Our results showed that most interviewed dentists prescribe prophylactic antibiotics inadvertently not following the current recommendations of recognized international associations.

Keywords: Dentists; Knowledge; Dental care; Chronic kidney failure; Renal dialysis.

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Article received on September 26, 2020.
 Article accepted on September 28, 2020.

DOI: 10.5935/2525-5711.20200018



INTRODUCTION

Chronic kidney disease (CKD) is a worldwide public health problem characterized by metabolic alterations and progressive irreversible loss of the kidney's ability to perform glomerular filtration^{1,2}. This disease has several levels of severity requiring kidney replacement therapy (KRT), usually haemodialysis (HD), during the final stage (i.e. chronic kidney failure). It is estimated that 15.2% of the North American adults have CKD¹. According to data from the Multicentric Longitudinal Study (*ELSA*), the prevalence of CKF in Brazil is 8.9%², reaching 12.7% in the State of São Paulo³.

Dental follow-up and handling of individuals with CKD on HD is important and represents a challenge for the dentist, especially when invasive dental procedures need to be performed⁴. In this case, concerns include altered drug metabolism, impaired immune response, reduced bone metabolism and increased risk of bleeding and increased risk of infective endocarditis (IE)⁴⁻⁸.

Infective endocarditis has been recognized as a haemodialysis complication since 1966 and there are reports of different incidence rates, ranging from 1.1% to 12%. In addition, the risk of IE in individuals on haemodialysis is 17 percent higher than in the general population^{9,10}. Nevertheless, the 2007 American Heart Association (AHA) guidelines for prevention of IE did not include CKD patients on haemodialysis as well as those at higher risk for such a disease¹¹. The European Heart Academy guidelines issued in 2015 also do not recommend the prophylactic use of antibiotics prior to invasive dental procedures for CKD patients on haemodialysis¹². Especially because the source of IE in those individuals is mostly bacteria from skin.

We did not identify previous studies investigating the knowledge and attitudes of Brazilian dentists towards the dental treatment of individuals with CKD on HD. Therefore, our objective was to assess such knowledge, attitudes, and practices of these practitioners using a questionnaire. Our hypothesis is that the majority of the dentists feel uncomfortable when performing invasive dental treatment in CKD patients, and that their clinical decision-making regarding antibiotic prophylaxis is not based on scientific evidence.

METHODOLOGY

Ethical Aspects

The present study was approved by the research ethics committee of the Dental School of University

of São Paulo according to protocol number 3.179.903. All the participants signed an informed consent form according to directives of the resolution number 466/12 of the National Health Board¹³.

Types of Study

This is a cross-sectional observational study assessing the knowledge, attitudes, and practices of Brazilian dentists towards the dental treatment of CKD patients undergoing haemodialysis.

Study Population

The study population consisted of dentists registered in the Regional Dental Board of São Paulo who actively practise the profession in the city of São Paulo. According to data from CROSP¹⁴, in 2016 there were 28,660 professionals working actively in the state of São Paulo. Therefore, the sample size was calculated by using the STATCALC tool of the software Epi-info 7.0 based on the following formula: $n = \lceil \frac{EDFF * Np(1-p)}{(d2/Z21 - \alpha/2 * (N-1) + p * (1-p))} \rceil$. Sample error of 5%, confidence level of 95%, estimated frequency of 50% for surgeon-dentist's knowledge, and correction factor of 1.2 to increase precision. In this way, the ideal sample size for developing the present study was of 455 surgeon-dentists. However, the sample was increased by 10% to minimise possible losses. Therefore, the ideal final sample had 501 surgeon-dentists.

Pilot Study

In order to evaluate feasibility, duration, and improve upon the questions, a pilot study was carried out with 20 dentists who were randomly selected and were not included in the final sample.

Data Collection

This study was conducted between June and September 2019. A structured self-report form was specially developed for assessment of the level of knowledge, attitudes, and practices of the dentists. The questions addressed clinical knowledge towards dental treatment of patients with CKD, attitudes, and perceptions during invasive or non-invasive dental procedures, request of complementary laboratory tests and prescription of medications. Sociodemographic data on age, gender, educational time, academic degree, and higher education institution were collected by using the same questionnaire. These data were collected by emailing the questionnaire with the Google Forms tool.

It was mandatory that all the questions were answered so that the non-response rates could be minimised.

Statistical Analysis

The resulting data were tabulated and analysed by using the Statistical Package for the Social Science software (SPSS® for Windows, version 20.0, SPSS Inc., Chicago, IL, USA). Descriptive analysis of the data was performed by means of absolute frequencies, percentages, mean and standard deviation. Bivariate analysis used Pearson's chi-square and linear association tests for determining relationships between independent variables and surgeon-dentist's knowledge on prescription of prophylactic antibiotics before invasive or non-invasive dental procedures for CKD patients on HD. All statistical tests were performed at a significance level of $p < 0.05$.

RESULTS

Answers were obtained from 488 dentists (97.4% of the total sample), of which 163 (33.4%) were males and 325 (66.6%) were females. Mean age was 40 years old, ranging from 22 to 74 years. Table 1 shows demographic data. As for the educational time, 38.3% (187/488) had more than 30 years of educational background, with a mean time of 17 years. A total of 349 (71.5%) of the dentists reported to have some specialty certified by the Federal Dental Board, 105 (21.5%) have post-graduate

certification (i.e. master's degree). The most frequently reported specialties were orthodontics (94/488; 19.3%), endodontics (68/488; 13.9%) and implantology (65/488; 13.3%). Of the 488 participants, 30 (6.1%) were special needs dentists.

Table 2 shows the questions asked to dentists and their answers. In the first question, the dentists were asked whether they had already treated a CKD patient on haemodialysis, with 233 (47.7%) respondents answering 'yes'. As for questions 2 and 3, the majority of the respondents ($n = 256$; 52.4%) reported to feel "comfortable" and "very comfortable" when treating CKD individuals undergoing haemodialysis, but this percentage fell to 43.1% (210/488) when they were asked on invasive dental procedures (Table 2). In question 4, the majority of the respondents ($n = 327$; 66%) answered that they would request some complementary laboratory tests before treatment, such as complete blood test, coagulogram and serum levels of urea and creatinine. In questions 5 and 6, 89 respondents (18.2%) would prescribe prophylactic antibiotics prior to non-invasive dental procedures, and 385 (78.9%) would do so prior to invasive dental procedures (question 7). As a justification for the use of prophylactic antibiotics, the majority of the surgeon-dentists want to prevent colonisation of the venous access for haemodialysis (225/448; 57.4%) as well to prevent Infective endocarditis (176/488; 44.9%).

Female gender (268/385; 69.6%) and private higher education institution (250/385; 64.9%) were found to be associated with the prescription of prophylactic antibiotics prior to invasive dental procedures in CKD individuals on haemodialysis (X^2 test; $p < 0.005$) (Table 3).

DISCUSSION

The present study has shown that less than half of the interviewed dentists feel comfortable performing invasive dental procedures on CKD patients undergoing haemodialysis. The great majority of the dentists (79% of the respondents) reported that they would prescribe prophylactic antibiotics for these patients, before the invasive dental procedure. Moreover, 18% would prescribe these medications even in cases of non-invasive dental procedures, such as restoration, impression and prophylaxis. This finding calls attention to the fact that non-invasive dental procedures does not involve risk of infection, meaning that prophylactic antibiotic therapy is definitely not indicated prior to these dental treatments¹⁵.

Table 1. Demographic and educational characteristics of interviewed dentists.

Variables	n (%)
Age in years - μ , \pm	40.44 \pm 11.34 (Rank: 22-74)
Educational time in years - μ , \pm	17.00 \pm 11.34 (Rank: 7-26)
Gender	
Female	325 (66.6)
Males	163 (33.4)
Higher education institution	
Private	310 (63.5)
Public	178 (36.5)
Total	488 (100.0)
Academic degree	
Specialisation	349 (71.5)
Master's degree	105 (21.5)
Doctoral degree	49 (10.0)
Post-graduate course	18 (3.7)
Other courses	215 (44.1)
No course	33 (6.8)

μ - mean \pm - standard deviation

Table 2. Respondents' answers to the questionnaire on dental treatment in patients with chronic kidney disease undergoing haemodialysis in the State of São Paulo, Brazil.

Questions	Answer options	n (%)
1. Have you ever treated any patient with chronic kidney disease undergoing haemodialysis?	Yes	233 (47.7)
	No	255 (52.3)
2. How would you feel treating a patient with chronic kidney disease undergoing haemodialysis weekly?	Very uncomfortable	26 (5.3)
	Uncomfortable	134 (27.5)
	Indifferent	72 (14.8)
	Comfortable	212 (43.4)
	Very comfortable	44 (9.0)
3. How would you feel performing invasive dental treatments, such as single tooth extraction or sub-gingival scraping in a patient with chronic kidney disease undergoing haemodialysis weekly?	Very uncomfortable	51 (10.5)
	Uncomfortable	172 (35.2)
	Indifferent	55 (11.3)
	Comfortable	176 (36.1)
	Very comfortable	34 (7.0)
4. Would you require any complementary laboratory test for this patient before performing some of these invasive dental procedures?	Yes	327 (67.0)
	No	161 (33.0)
5. Would you prescribe patient with chronic kidney disease undergoing haemodialysis weekly prior to non-invasive dental procedures, such as direct and indirect restorations, supra-gingival scraping, shaping, among others?	Yes, I would prescribe prophylactic antibiotics	89 (18.2)
	No, I would not prescribe prophylactic antibiotics	367 (75.2)
	I do not know	32 (6.6)
6. Would you prescribe prophylactic antibiotics for a patient with chronic kidney disease undergoing haemodialysis weekly prior to invasive dental procedures, such as tooth extraction?	Yes, I would prescribe prophylactic antibiotics	385 (78.9)
	No, I would not prescribe prophylactic antibiotics	55 (11.3)
	I do not know	48 (9.8)
7. If you answered YES to the earlier question, choose one of the alternatives below:	Yes, I would follow the prophylactic antibiotic protocol recommended by the American Heart Association	277 (72.0)
	Yes, I would prescribe prophylactic antibiotic, with the first dose being given before the dental procedure and the other ones for at least 7 days.	98 (25.4)
	Yes, I would prescribe prophylactic antibiotic for at least 7 days, with the first dose being given after the dental procedure.	10 (2.6)
8. If you answered that you would prescribe prophylactic antibiotics for a patient with chronic kidney disease undergoing haemodialysis weekly prior to invasive dental procedures, mark the reason(s) why you would do so:	To prevent septicaemia	166 (42.3)
	To prevent bacterial endocarditis	176 (44.9)
	To prevent infection to other organs	158 (40.3)
	To prevent colonisation of the venous access for haemodialysis (i.e. arteriovenous fistula or catheter)	225 (57.4)
	To prevent local alveolus (i.e. alv infection in the eolitis)	112 (28.6)

Although invasive dental procedures can, at least theoretically, produce bacteremia and surgical site infection, scientific studies has been unsuccessful in demonstrating this possibility. Currently, the only guidelines addressing the use of prophylactic antibiotics for patients with end-stage kidney disease (ESKD) come from a 2003 scientific statement from the American Heart Association (AHA)¹⁶. Nowadays, according to the AHA, there is a lack of convincing evidence showing that microorganisms associated with dental procedures can cause infection of prosthetic vascular grafts used for haemodialysis¹¹. Therefore, AHA recommends only the use of prophylactic antibiotics before invasive dental procedures, for patients undergoing haemodialysis who have cardiovascular risks¹⁶.

In addition to anaphylactic reactions and cost with antibiotics, it should also be emphasised that the inadequate use of antibiotics increases number of resistant microorganisms. The high levels of resistance to penicillin, as observed with oral streptococci, are of concern and related to cases in which patients are given doses of short-term antibiotics¹⁷. A single dose of 2g of amoxicillin to be given one hour before the dental procedure, according to AHA protocol¹¹, would have little or no effect on the emergence of resistant microorganisms and would significantly reduce bacteremia. Nevertheless, repeated doses of prophylactic antibiotics during dental treatments can lead to a significant increase in the number of resistant microorganisms¹⁷.

Table 3. Associations between independent variables and prescription of antibiotics by dentists prior to invasive dental procedures in patients with chronic kidney disease undergoing haemodialysis.

Variables	Would not prescribe	Would prescribe	P-value
	(n = 55) n (%)	(n = 385) n (%)	
Gender			
Female	29 (52.7)	268 (69.6)	0.012*
Male	26 (47.3)	117 (30.4)	
Age group			
Up to 30 years old	16 (29.1)	88 (22.9)	0.218**
Between 31 and 40 years old	18 (32.7)	108 (28.1)	
Between 41 and 50 years old	09 (16.4)	96 (24.9)	
More than 50 years old	12 (21.8)	93 (24.2)	
Higher Education Institution			
Private	29 (52.7)	250 (64.9)	0.049*
Public	26 (47.3)	135 (35.1)	
Educational time			
Up to 10 years	21 (38.2)	133 (34.5)	0.601**
Between 11 and 20 years	17 (30.9)	106 (27.5)	
More than 20 years	17 (30.9)	146 (37.9)	

* p-value for Pearson's chi-square test. ** p-value for linear association test.

Scientific evidence shows that there is a low rate of infection in healthy individuals after invasive dental procedures and that prophylactic antibiotics given to prevent possible infections have little effect on the reduction of these complications. On the other hand, bacteremia is common following invasive dental procedures and when bacteria enter the blood circulation, they can potentially cause infections at distant sites, such as infective endocarditis and infection of joint prosthesis¹⁸. However, these risks are considered for individuals with congenital cardiopathies or joint prosthesis. There is no scientific evidence showing that the use of antibiotics prior to dental procedures in CKD patients on haemodialysis is beneficial¹¹.

The increased risk of infective endocarditis among individuals with CKD is mostly related to the recurrent use of vascular access through arteriovenous fistula and venous catheter during haemodialysis procedures as well as to skin microorganisms such as *Staphylococcus aureus*. Episodes of infective endocarditis associated with *Streptococcus viridians*, which may be present in the mouth, have been reported in 15% of the cases^{9,10}. Nevertheless, there is no evidence that

transient bacteremia triggered by dental procedures increases the risk of bacterial endocarditis in CKD patients undergoing haemodialysis^{4,19}. Despite this, some authors, institutions, and professionals recommend the use of prophylactic antibiotics for these patients^{5-7,20,21}.

A recent study investigated dental treatment protocols for CKD patients recommended by 24 North American dental schools. The authors found that these recommendations were not standardised, with 13 (52%) dental schools reporting to have no protocol for treating these patients. Of the 11 (48%) remaining dental schools, 54% recommend the use of prophylactic antibiotics before dental procedures according to the dose protocol established by the AHA, whereas 62% used a protocol modified by the institution²⁰. A similar study assessed dental treatment protocols for CKD patients in dental residency programs in the United States. Thirty-four percent of these programs reported using their own protocol for treating these patients and 65.5% reported using the AHA protocol²¹.

The lack of scientific evidence regarding the actual necessity of prophylactic antibiotics, including their efficacy, is the main reason for the lack of uniformity in the attitudes of health professionals, such as physicians and surgeon-dentists^{20,22}. Based on the methodology and results of this study, one can demonstrate that dentists should use their scientific knowledge in the dental practice, particularly for CKD individuals undergoing haemodialysis.

CONCLUSION

Our results showed that most interviewed dentists feel uncomfortable when performing invasive dental treatments in CKD patients who are on haemodialysis, usually prescribe excessive antibiotics prophylactically, thus not meeting the current recommendations for use of prophylactic therapy. Professionals female and graduated in private higher education institutions are the ones who most use prophylactic antibiotics inadvertently.

In summary, this study revealed that Brazilian dentists have poor knowledge on the use of prophylactic antibiotics for CKD patients on haemodialysis. These alarming results call for an immediate action to improve their knowledge on prophylactic antibiotics. Therefore, given the increasing prevalence of chronic kidney disease in Brazil, education on how to treat CKD patients should be continuously and periodically offered.

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