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Dental care before cardiac valve surgery: Is it important to prevent infective endocarditis?

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ABSTRACT

Background: Infective endocarditis (IE) is a serious disease that affects the surface of the endocardium. The spread of microorganisms from the oral cavity has been associated with the occurrence of IE.
Objective: To analyze whether dental treatment before cardiac valve surgery (CVS) influenced the occurrence of IE.
Methods: We performed a retrospective analysis of the medical and dental histories of patients undergoing CVS from 2004 to 2014. The sample consisted of 481 patients who underwent CVS divided into two groups: patients submitted to dental treatment prior to CVS ($n = 110$) and patients undergoing CVS without dental treatment ($n = 371$).
Results: Of the total sample, 38 patients (8%) were diagnosed with IE. No significant difference was detected ($p = 0.496$) in comparing the occurrence of IE in the group with dental preparation (6.4%) and without dental preparation (8.4%). The logistic regression model confirmed that dental treatment did not change the IE risk ($p = 0.504$) and indicated that age ($p < 0.003$) and gender ($p = 0.013$) were significant risk factors for IE. There was a high demand for dental procedures in the group receiving dental preparation, with no significant differences between the patients with or without IE. Hemoculture indicated qualitative differences in comparing patients with and without dental treatment, especially in the frequency of *Staphylococcus* and *Streptococcus*.
Conclusions: The results did not allow for the determination of the impact of dental treatment before CVS on IE outcomes. However, it was not possible to exclude the potential beneficial effects of dental treatment in the prevention of IE.

1. Introduction

The spread of microorganisms from the oral cavity to other sites has been associated with the occurrence of systemic diseases such as infective endocarditis (IE) [1–4]. IE is a severe disease that affects the surface of the endocardium [5–7], occurring more frequently in the vicinity of acquired or congenital heart defects [8–10]. The pathogenesis of IE has been associated with the occurrence of bacteremia, the source of which can include periodontal infection sites [11–16], dental and/or oral tissues manipulation [4,8,17–19] and even daily lifestyle habits (*e.g.*, brushing and flossing) [8,20,21].

In the presence of infection, tooth-supporting tissues became highly vascularized and enter into an intimate relationship with microbial biofilm, increasing the risk of bacteremia [3,15,22]. Surmounting evidence has indicated that dental treatment in patients at risk of developing IE could be beneficial because the elimination and/or control of acute or chronic oral infections can reduce the source of microorganisms and consequently the likelihood of bacteremia [8,11,12,14]. However, the costs and benefits of dental intervention prior to cardiac valve surgery (CVS) have not been well defined. One study demonstrated an increased risk of adverse cardiac events, including a 3% likelihood of death when dental extraction was performed before cardiac surgery [23]. Another study showed no difference in the incidence of IE or other cardiac complications in patients who underwent dental surgery concomitantly with CVS [24]. In contrast, a higher incidence of IE was previously noted in the treated group (5.4%), compared to the group

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that did not receive (1.9%) dental treatment before valve surgery [25]. Therefore, if dental intervention before CVS is beneficial in preventing post-operative IE requires further investigation.

Recently modifications were introduced to the international recommendations on IE prevention concerning dental procedures [26–28]. These modifications have exacerbated discussions and controversies in the literature concerning the associations between oral infection and dental treatment *versus* IE. Because dental infection potentially induces bacteremia and consequently IE, we evaluated here the potential effects of dental treatment performed before CVS on overall IE outcomes.

2. Materials and methods

2.1. Study design

A retrospective analysis of medical records of patients who underwent cardiac valve surgery from June 2004 to May 2014 was performed at the Hospital das Clínicas of the Universidade Federal de Minas Gerais. This study was approved by the Institutional Ethics Committee (Protocol 24287014.9.0000.5149). Patients aged 18 years old or older who underwent cardiac valve surgery and who were submitted or not to dental treatment before the procedure were included in this study. We excluded patients younger than 18 years old, patients with pacemakers, those with indefinite diagnoses of infective endocarditis (IE) and patients whose medical records had no information about the clinical data of interest.

2.2. Infective endocarditis diagnosis

The criteria for the IE diagnosis were defined by the Duke group [17,19,27]. Data collected included age, sex, hospitalization duration, presence of diabetes mellitus, systemic arterial hypertension, acute myocardial infarction, cerebrovascular accident/transient ischemic attack (stroke), chronic renal failure, smoking habit, previous cardiac surgery, rheumatic fever and death. The variable mortality was stratified as up to 30 days after CVS and >30 days until one year after CVS. Data from hemoculture from patients with IE were also obtained.

2.3. Dental treatment

Dental evaluation consisted of anamnesis and clinical and radiographic examinations. Oral mucosa, teeth, gums and alveolar bone were evaluated. This evaluation aimed to identify infectious foci, such as caries, periodontal and endodontic disease. Patients submitted to invasive dental procedures received antibiotic prophylaxis following AHA recommendations (2014) [26]. Data on the type of dental procedure performed were collected: coronal polishing, scaling and root planning, restorative procedures, endodontic treatment, extractions, biopsies, abscess drainage and hemorrhage control. The number of appointments dates of the beginning and end of dental treatment and whether the dental treatment was considered completed or not before surgery were recorded.

2.4. Statistical analysis

Data analysis involved the description of frequencies for the categorical variables according to the response variable 'IE' and the main explanatory variable 'preoperative dental care', with the chi-square test used to determine associations between these variables. Because the scale variables did not have a normal distribution (Kolmogorov–Smirnov test <0.05), the Mann–Whitney test was used to compare the two independent groups in the measurement of these variables. A multivariate binary logistic regression model was constructed, estimating odds ratios (ORs) for IE and respective 95% confidence intervals (CIs) for the groups of patients with and without preoperative dental care, adjusted according to other independent variables. Covariates with p-values <0.20 in the bivariate analysis were incorporated into the model, which was built by the 'enter' method. Variables that remained significant ($p < 0.05$) after adjustments were maintained in the final model. The covariates 'previous cardiac surgery' and 'rheumatic fever' were included and retained in the model for adjustment regardless of their p-values because the groups that received preoperative dental care or not differed with regard to these variables at baseline. Similarly, 'preoperative dental care' was forced into the model because it was the variable of interest. The Hosmer and Lemeshow test was used to assess the model fit. A multivariate multinomial logistic regression model was also constructed, similar to that having 'mortality' as the outcome variable.

All of the statistical analyses were performed using the SPSS™ statistics software (SPSS for Windows, version 20.0, SPSS Inc., Chicago, IL, USA), and the level of significance adopted was 5%.

3. Results

A total of 481 records of patients who underwent cardiac valve surgery between 2004 and 2014 were analyzed. Of the total, 371 patients (77%) did not receive dental treatment, and 110 patients (23%) underwent dental preparation before CVS.

A comparative analysis was performed between the groups with and without dental preparation, and no significant difference was observed in the sex distribution ($p = 0.191$). The number of patients with smoking habits was also similar in both groups ($p = 0.504$). Patients who underwent dental treatment were younger ($p = 0.032$) and had a higher percentage of previous cardiac surgeries ($p = 0.032$) than the group without dental preparation (Table 1).

The comparison between the groups with and without dental preparation concerning principal diagnosis showed similar rates of diabetes mellitus ($p = 0.104$), systemic arterial hypertension ($p = 0.756$), acute myocardial infarction ($p = 0.773$), cerebrovascular accident ($p = 0.923$) and chronic renal failure ($p = 0.609$). There was a significant difference in the occurrence of rheumatic fever ($p < 0.001$), which was more frequent in the group with dental preparation (53%) than in the group without dental preparation (21%) (Table 1). The hospitalization duration in the group that underwent dental treatment (Md = 21.5 days) was significantly longer than in the group without dental preparation (Md = 14.0 days) ($p < 0.001$).

Of the total sample, 38 patients (8%) were diagnosed with IE. The results showed no significant difference ($p = 0.496$) between the occurrence of IE in comparing the group with dental preparation (6.4%) and

Table 1
Demographic data and principal diagnosis of patients who underwent cardiac valve surgery considering dental preparation before surgery.

Variables	Dental treatment		p-Value
	Yes	No	
Female	56 (51.0%)	215 (58.0%)	0.191[a]
Male	54 (49.0%)	156 (42.0%)	
Age (years)	47.3 ± 15.5 (Md = 48.5)	51.2 ± 16.4 (Md = 53.0)	**0.032**[b]
Smoking habit	16 (15.0%)	45 (12.0%)	0.504[a]
Previous cardiac surgery	38 (35.0%)	90 (24.0%)	**0.032**[a]
Diabetes mellitus	8 (7.0%)	48 (13.0%)	0.104[a]
Systemic arterial hypertension	57 (52.0%)	186 (50.4%)	0.756[a]
Acute myocardial infarction	6 (5.0%)	23 (6.2%)	0.773[a]
Cerebrovascular accident	8 (7.0%)	28 (7.6%)	0.923[a]
Chronic renal failure	8 (7.0%)	22 (5.9%)	0.609[a]
Rheumatic fever	58 (53.0%)	78 (21.0%)	<**0.001**[a]

Md: median. p values less than 0.05 appear in bold.
[a] Chi-square test.
[b] Mann-Whitney.