Association between Angiographically-Defined Coronary Artery Disease and Periodontal Diseases

Aliakbar Khoshkhonejad, MD; Ahmad Mohebi, MD*
and Farkhondeh Raiessadat, MD

Abstract

Background- Results of studies seeking for the association between periodontal diseases and coronary artery disease (CAD) are significantly inconsistent. Such inconsistency has been attributed to the varying definitions for CAD and whether or not adjustment for common risk factors has been performed. The main objective of this study was to investigate the association between angiographically- defined CAD and periodontal diseases.

Methods- Fifty-eight patients, who referred to Shaheed Rajaie Cardiovascular Medical Center, were recruited into a case-control design study. They were examined for periodontal indices such as the papillary bleeding index (PBI), probing depth (PD), plaque index (PI) and clinical periodontal attachment level (AL). The subjects were classified as having CAD (CAD+) if they had at least 50% stenosis in at least one major epicardial artery.

Results- Thirty-nine patients (67.2%) were CAD+ and 19(32.8%) were CAD- .CAD+ patients were more likely to be male than female (90.3% versus 40.7%, p=0.000) and of older ages (55±2.7 versus 40.6±4.8, p=0.000). Among periodontal parameters, no significant association was found between the mean of PBI, PD and CAD. On the other hand, there was a significant association between the amount of AL, PI, number of missing teeth and CAD. There was also correlation between the amount of AL and the number of vessels involved (r=0.428). The results of this study remained unchanged after adjustment for CAD risk factors, performing multilogistic regression analysis.

Conclusion- The observation showed a significant relationship between angiographically-defined CAD and periodontal diseases, which can emphasize the importance of early diagnosis and complete treatment of periodontal infections, particularly in CAD susceptible individuals ***(Iranian Heart Journal 2005; 6 (1,2): 31-36).***

Key words: periodontal diseases■ coronary artery disea

Coronary artery disease (CAD) is a major cause of morbidity and mortality[a]. For example, 50% of mortalities occurring in the United States are due to atherosclerosis[b].

The etiology of CAD is multi-factorial. Recent evidence suggests a role for infectious agents in the pathogenesis of CAD; viral and bacterial infections may contribute to both initiation and progression of CAD.

Animal studies have shown that atherum plaque formation can be enhanced by exposure to periodontal pathogens[c].

Some believe that pathogenic bacteria inoculated from the oral environment into the bloodstream may translocate to atherosclerotic lesions or may induce platelet aggregation, leading to thromboembolic events[1].

On the contrary, other studies maintain that common risk factors such as diabetes

mellitus, smoking and dietary habits are the reason of association between CAD and periodontal diseases.

According to the literature, 5-60% of the population in different communities is affected by periodontal diseases[d].

In our country, 27% and 34% of 15-69 year-old people have gingivitis and periodontitis, respectively. Seventy percent of them are in the range of 40-69 years old[4,8,9]. Accordingly, if any association exists between periodontal diseases and CAD, the prevalence of CAD and its consequences can be reduced by oral hygiene education, early diagnosis and effective treatment of periodontal diseases. The results obtained from research conducted in other countries (societies) are not necessarily useful for our population because of differences in race, dietary habits, health situation and prevalence of various risk factors. The criteria for choosing CAD patients in previous research in our country were not based on angiography.

Therefore, this research was conducted based upon angiography as the gold standard for the diagnosis of CAD and routine periodontal examinations.

Methods

This study was an observational- analytic study. Between April and October 2004, fifty-eight individuals were randomly selected from patients having presented for angiography at Shaheed Rajaie Cardiovascular Medical Center. The exclusion criteria were: edentulousness, existence of artificial heart valve and non-compliance of the patients to participate in the study.

Records were assessed and reviewed for cardiovascular risk factors, including hypertension, low- density lipoprotein (LDL), high-density lipoprotein (HDL), cholesterol and triglyceride levels and fasting blood sugar (FBS). The values of blood pressure and blood biochemistry were obtained from each patient's hospital medical records. The patients were asked about family history of heart diseases and smoking.

A periodontal examination was performed to measure the following clinical parameters per 6 teeth: **(**Ramfjord teeth) Maxillary right first molar, left central incisor and first premolar, mandibular left first molar, right central incisor and first premolar. Distal neighboring tooth was selected in the absence of Ramfjord teeth (due to extraction)

(Ramfjord teeth): Plaque Index (PI), Papillary Bleeding Index (PBI), Probing Depth (PD), clinical Attachment level (AL) and number of missing teeth (not considering third molars). PI was determined by moving a periodontal probe along the margin the gingiva and scored by Silness and Loe [12] (score 0: no plaque in gingival area; score 1: a film of plaque adhering to the free gingival margin; score 2: moderate accumulation of plaque that can be seen with the naked eye; score 3: abundance of soft matter at the gingival margin).

PBI was determined as described by Muhlemann after probing the gingiva at interproximal areas [12](from score 0: no bleeding to score 4: sever bleeding).

PD is measured from the margin the gingiva to the base the gingival sulcus (or periodontal pocket) with a millimeter-calibrated probe.

AL is measured from the cementoenamel junction of the tooth to the base of gingival sulcus (or periodontal pocket) with a millimeter-calibrated probe.

All the experiments were performed by the same examiner, the day before the angiography appointment. The subjects were classified based on the results of diagnostic angiography as: Cases CAD+ or Controls, CAD- (by) a cardiologist according to the following criteria:

CAD+ was defined as greater than 50% diameter reduction in at least one major epicardial artery .Severity of CAD was

also measured by the number of vessels affected.

Data were analyzed by using t-student test to compare group means and chi-square test for the comparison of categorical variables. Logistic regression analysis was used to analyze the association between periodontal diseases and CAD, after adjusting fo common risk factors. SPSS (version 11.0) software was used for these data analyses.

Results

Fifty-eight patients, who were candidates for diagnostic angiography, were examined. Among them, 39 (67.2%) were CAD+ and 19 (32.8%) were CAD-. There were 31 (53.4%) males and 27 (46.6%) females.

The prevalence of CAD+ was significantly different between the male and female patients (p=0/000). Twenty-eight males (90.3%) and 11 females (40.7%) had coronary artery involvement (Table I).

Table I. Prevalence of coronary heart disease in the study population according to sex.

CAD / Sex	CAD+		CAD -		SUM	
	prevalence	%	prevalence	%	prevalence	%
Male	28	90.3	3	9.7	31	100
Female	11	40.7	16	59.3	27	100
Sum	39	67.2	19	32.8	58	100

CAD: Coronary Artery Disease.

From the viewpoint of age prevalence, 1 patient (1.7%) of less than 40 years old, 30 (51.7%) of 40-60 years old and 8 patients (13.8%) of greater than 60 years were CAD+.

The mean ages of the patients in total, in male and female individuals, were 50.3±11.4, 54.1±8.9 and 45.9±12.6, respectively.

The mean ages of CAD+ and CAD- individuals were significantly different from each other (p=0.000). They were 55±8.6 and 40.6±10.6 years in CAD+ and CAD- patients, respectively.One, two and three- vessel involvements were observed in 41%, 33.3% and 25.6% of CAD patients, respectively.

Twelve patients (30.8%) of the CAD+ group were smokers or had a history of smoking, and 27 (69.2%) of them were non-smokers. There were significant differences between CAD+ and CAD- patients in the mean of diastolic and systolic blood pressure. On the other hand, they did not have significant difference in the mean of LDL, HDL, CHOL, TG and FBS (Table II).

Table II. Mean and standard deviation of CAD risk factors in the study population.

Risk Factors	CAD	Mean	Standard deviation	Confidence interval	P value
TG	**CAD+** **CAD -**	220.3 182.1	227.9 89.9	220.3 ± 73 182.1 ± 41.2	0.485 0.366
LDL	**CAD +** **CAD -**	116 113.2	37.3 39.9	116 ± 12 113.2 ± 18.3	0.797 0.802
HDL	**CAD +** **CAD –**	74.2 49.7	9.8 12	47.2 ± 3.1 49.7 ± 5	0.369 0.391
CHOL	**CAD +** **CAD -**	212.3 194.1	68.6 43.8	212.3 ± 22 194.1 ± 20.1	0.294 0.225
FBS	**CAD +** **CAD _**	112.3 110.2	43.9 52.3	112.3 ± 14.1 110.2 ± 24	0.873 0.881
BP (systolic)	**CAD +** **CAD –**	124.7 111.3	19.2 12.5	124.7 ± 6.2 111.3 ± 5.7	0.008 0.002
BP (diastolic)	**CAD +** **CAD -**	74.4 65.6	15.7 12.1	74.4 ± 5 65.6 ± 5.6	0.036 0.024

CAD: Coronary Artery Disease / TG: Triglyceride / LDL: Low Density Lipoprotein / HDL: High Density Lipoprotein / CHOL: Cholesterol / FBS: Fast Blood Sugar / BP: Blood Pressure.

The mean of PBL was 1.9±0.9 in CAD+ and 1.6±0.8 in CAD- patients. There was no significant difference between these two groups (p=0.296). The mean of PD was 3.3±1.1 min and 2.9±0.7 min in CAD+ and

CAD- patients, respectively. Again they had no significant difference (p=0.16).

The mean of PI was 2.3±0.97 and 1.7± 0.8 in CAD+ and CAD-patients, respectively, which was significantly different from each other.

The mean of AL was 3.97±1.09 mm in CAD+ and 3.3±l.08 in CAD- patients. They were significantly different from each other (p= 0.035).

According to the results, with increasing amounts of AL in CAD+ patients, the number of the affected coronary vessels increased. So, there was significant relationship between these two parameters (r= 0.428 and P= 0.007, Table III).

Table III. Prevalence of the number of vessels involved according to the level of periodontal clinical attachment level.

Number of Vessel / Clinical attachment	One vessel		Two vessel		Three vessel		Sum	
	prevalence	%	prevalence	%	prevalence	%	prevalence	%
less than 3 mm	5	71.4	2	28.6	0	0	7	100
between 3-6 mm	11	36.7	10	33.3	9	30	30	100
greater than 6 mm	0	0	1	50	1	50	2	100
Sum	16	41	13	33.3	10	25.6	39	100

Spearman correlation r = 0.428

The mean number of extracted teeth was 7.5±4 and 4.4±3.8 in CAD+ and CAD-patients, respectively. The difference was statistically significant (P= 0.007).

Considering the risk factors of CAD and performing multi-logistic regression analysis, all the mentioned results remained unchanged.

Discussion

This research is the first evaluation of association between periodontal diseases and CAD in our country in which angiographic data have been used for determination of CAD+ and CAD- individuals.

The mean age of CAD+ patients was significantly more than that of CAD- patients, which was the same as that reported by Bazile et al[5].

The prevalence of affected people with CAD was the same as that reported by Malthaner et al[1].There was also a significant difference in the prevalence of CAD between the two sexes (P<0.05).

In this research, among the risk factors of heart diseases like cholesterol, LDL, HDL triglyceride, FBS, familial history of heart diseases and diastolic and systolic blood pressure, there was only a significant association between the mean diastolic and systolic blood pressure with coronary artery disease.

However, Malthaner et al. reported that mean HDL and cholesterol levels were the only relevant variables with coronary artery disease.[1] The mentioned study also emphasized that all the smokers were in the CAD+ group.

The present study showed a significant relationship between coronary artery disease and the mean of AL (attachment level), which was similar to the results of Mattilla et al.,[6] Destefano et al.,[7] Beck et al.,[2] Khorsand et al.,[8] and Moghaddas et al.,[9] There was also an association between the amount of AL and the number of affected coronary vessels (r=0.428).

There was a significant relationship between CAD+ and the number of extracted teeth, which is in accordance with the studies of Joshipura et al,[10] Loesche et al,[11] Khorsand et al.[8] and Moghaddas et al[9]. Bazile et al., however, did not find any relationship between these two variables[5]. Differences in the socioeconomic status of patients in various studies could explain such inconsistent results.

Mean of the plaque index was significantly

different between the CAD+ and CAD- groups, which was the same as the results of Joshipura et al. and Loesche et al. It was the same, however, in the control and case groups in the study of Bazile et al. (0.7 versus 1.3), and it was attributed to the socioeconomic conditions of the selected population.

Bazile et al. and Malthaner et al. did not find any significant relationship between the mean of probing depth and having CAD, which was the same as the finding in our study.

According to the results of this research, there was no significant relationship between the papillary bleeding index and CAD+, but Khorsand et al. reported opposite results. This inconsistency can be related to the method of the research. In both studies, the Muhlman index was used for evaluating PBI. In our study, first, all the surfaces of the tooth were probed with a calibrated probe and then, a maximum amount of PBI was selected as the tooth index. Khorsand et al., on the other hand, measured it in the lingual and facial surfaces in randomly selected quadrants of the mouth. It should be mentioned that the results of this study did not change after adjusting the risk factors of CAD and analyzing by multi-logistic regression. The results of previous studies on the association between periodontal and heart diseases were inconsistent. According to Genco et al,[3] possible reasons for these inconsistent findings could include:

1) Differences in the age of the subjects participating in different studies (It seems that the association between periodontal diseases and coronary heart disease is stronger in younger individuals.).

2) Lack of control of confounding factors like smoking status, which is a common risk factor for both diseases. In this study, adjustment was done for all confounders.

3) Type of heart disease that is considered (CHD, stable angina, unstable angina ,.....) and the way they are measured. While several studies have utilized angiographic data for the assessment of CAD[1,5,6], some others have relied upon data such as patient histories and hospital records to establish the CAD status[2,10] . In the present study, patients with >50 % stenosis in one or more epicardial arteries were considered positive for CAD. This definition defines the patient with hemodynamically significant stenosis.

4) Measures of periodontal diseases: some studies have used the total dental index, which is a combination of probing measures, furcation involvement and dental caries infections. Some others have used Russell's periodontal index, or RPI, which is a non-probing index. One study has used bone loss[2], and several other studies have used self-reported periodontal diseases [10]

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