Relationship Between Periodontal Disease and Acute Myocardial Infarction

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Background: Conventional risk factors for coronary artery disease and myocardial infarction do not explain all of the clinical and epidemiological features of the disease. Periodontal disease is a common bacterial and destructive disorder of oral tissues. Many studies demonstrate close association between chronic periodontitis and development of generalized inflammation, vascular endothelial injury, and atherosclerosis. Periodontal disease has been convincingly emerging as an important independent risk factor for ischemic heart disease. A case-control study was carried out to assess the prevalence of periodontitis in patients with Acute myocardial Infarction (AMI) and evaluate the possible relationship between AMI and chronic periodontitis.

Patients and Methods: A number of 160 patients, aged 35 to 70 years old, enrolled in the study. Eighty patients (43 men, 37 women) were examined four days after hospitalization due to AMI. Control group consisted of 80 persons (38 men, 42 women) with normal coronary angiography. The following periodontal parameters were examined: Plaque index (PI), gingival index (GI), bleeding on probing (BOP), probing depth (PD), clinical attachment loss (CAL) and number of sites with CAL.

Results: The case, compared to control showed significantly worse results for some periodontal variables studied: The mean of PD and PD > 3 mm, CAL, and number of sites with CAL, had worse results compared to control despite similar oral hygiene and frequency of brushing. The confounding factors for the present study were found to be hypertension and diabetes.

Conclusion: The association between periodontitis and acute myocardial infarction was significant after adjusting for conventional risk factors for AMI.

Keywords: Coronary Artery Disease, Periodontal Disease, Acute Myocardial Infarction.

Introduction

Epidemiologic and pathologic studies suggest that only half to two thirds of cardiovascular risk is explained by the classic risk factors.¹⁻³ Periodontal disease is a chronic gram Negative oral infection that has been associated with an increased risk for cardiovascular events.⁴⁻⁶ The chronic inflammatory process of periodontitis and the host response provide the basis for the hypothetical association between coronary Artery disease (CAD) and periodontal disease. Some individuals may respond to a given microbial or lipopolysacharide (LPS) challenge with an exaggerated intense inflammatory response, as reflected in high levels of pro-inflammatory mediators such as prostaglandin E₂ (PG E₂), interleukin – 1 B (IL – 1B), and tumor necrosis factor -α (TNF - α).⁷

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A number of studies have reported that periodontal disease is associated with cardiovascular outcomes such as myocardial infarction, coronary artery disease (CAD) and stroke. Two studies reported that CAD is the condition most commonly found in patients with periodontitis.\textsuperscript{8,9} Joshipura et al. found a significant association between teeth loss due to periodontal disease and CAD in men.\textsuperscript{10} Paunio et al. also reported an association between missing teeth and ischemic heart disease.\textsuperscript{11} In addition, edentulous individuals have been shown to have rates of cardiovascular disease equal to or exceeding the rates in individuals with periodontal disease.\textsuperscript{12,13}

The purpose of present case – control study was to assess the periodontal condition of patients with AMI and verify the possible association between AMI and certain clinical periodontal parameters.

**Patients and Methods:**

The study protocol was approved by the ethical committee of Shiraz University of Medical Sciences. All participating subjects provided informed consent. A total of 160 patients aged 35-70 years were enrolled in the study. Cases consisted of 80 patients during their index admission with AMI. Control group consisted of 80 persons with no angiographic evidence of CAD.

AMI was diagnosed on the basis of a history of chest pain lasting \(\geq 30\) minutes with ischemic electrocardiographic abnormalities and serial serum creatine kinase – myocardial band (CK-MB) and serum troponin I (TnI) level.

The diagnosis of ST elevation myocardial infarction (STEMI) was made if there was ST segment elevation of \(2\) mm or more in precordial leads or \(1\) mm or more in limb leads and non ST elevation myocardial infarction (NSTEMI) was diagnosed if there was ST depression and / or T wave inversion combined with typical rise of serial CK – MB and TnI levels according to local laboratory standards.

Both patients with (STEMI) and (NSTEMI) were included in the study and undergone a through oral examination after \(4\) days of hospitalization when all were free of anticoagulation therapy.

Subjects who used immunosuppressant and antidepressant drugs, chemotherapy, antibiotics in previous 2 months, those with renal failure, with less than 8 teeth, with periodontal treatment within the preceding two months and finally patients with concomitant valvular heart disease as well as those requiring bacterial endocarditis prophylaxis were excluded.

Every patient underwent a complete clinical examination. Method for measurement of body mass index (BMI), waist to hip ratio, and blood pressure have been described previously.\textsuperscript{14,15} Hypertension was defined as having a systolic blood pressure\(\geq 140\) mmHg. and/or diastolic blood pressure\(\geq 90\) mmHg. or receiving blood pressure reducing medications. Plasma high density lipoprotein (HDL) and low density lipoprotein (LDL) cholesterol, triglyceride, and fasting serum glucose (all in mg/dl) were checked using enzymatic calorimetric determination method.

Diagnosis of hyperlipidemia was made according to National cholesterol education program adult treatment panel III (NCEP – ATP III) and also included persons consuming anti lipid medications. Participants were categorized as
smoker if they were current smoker and non-smoker if they were not.

Periodontal Examination

The periodontal measurements were performed at the bedside by one of the researchers, using mirrors, William’s probes with Michigan markings (HU–Friedy), and portable lamps (Duracell).

All teeth excluding third molars were examined for periodontal PD and CAL at six sites per tooth, using mm-graded periodontal probes.

All measurements were rounded to the lowest whole mm. Teeth and/or sites in which the cementoenamel junction could not be identified due to severe crown destruction or gross calculus deposits were excluded. The presence or absence of gingival bleeding was assessed approximately 30 seconds after pocket depth probing.

The plaque and gingival indices were determined by using the plaque index and gingival index for each tooth as described by Loe.

The degree of periodontitis was defined as previously reported by the percentage of sites with loss of attachment > 3 mm as following: 0% = absent, 1-32% = mild, 33-66% = moderate, 67 – 100% = severe.

Although a blind observer method would have been preferable for clinical examinations, the fact that the acute myocardial infarction and angiographically normal patients were in different departments made this scenario impractical.

Statistical Analysis:

The chi-square and student t-test were used to compare the results between case and control group. To identify the risk factors as confounding factors a multiple logistic regression model was constructed. A P-value of less than 0.05 was considered significant. Analysis were performed with SPSS (windows version 13.0 software package).

Results

Mean age of control and cases were 51.9 and 54 years respectively (Table 1).

Table 1. The age of control and cases

<table>
<thead>
<tr>
<th>Age in controls</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in controls</td>
<td>80</td>
<td>35.0</td>
<td>70.0</td>
<td>51.9</td>
<td>9.4</td>
<td>0.031</td>
</tr>
<tr>
<td>Age in cases</td>
<td>80</td>
<td>39.0</td>
<td>70.0</td>
<td>54.0</td>
<td>8.7</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Degree of periodontitis in persons with and without AMI

<table>
<thead>
<tr>
<th>N</th>
<th>Percentage</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absent-mild</td>
<td>Control</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Case</td>
<td>9</td>
</tr>
<tr>
<td>Moderate</td>
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<td>45</td>
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<tr>
<td></td>
<td>Case</td>
<td>52</td>
</tr>
<tr>
<td>Severe</td>
<td>Control</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Case</td>
<td>19</td>
</tr>
</tbody>
</table>
Statistically significant differences were found between acute infarction cases and the control group in regard to the number of sites with PD > 3mm, clinical attachment loss and sum of PD and CAL (P=0.016) (Table 2). The cases showed worse results for periodontal variables studied (gingival recession, PD > 3mm and CAL) versus control. However there were no significant difference in BOP and PI and GI between case and control group (Table 3).

**Discussion:**

The present study demonstrated that subjects with AMI had significantly higher proportion of sites with gingival inflammation. In our study, we compared moderate and severe degree of periodontitis with absent to mild periodontitis. Advanced periodontitis probably implies a sufficiently long evolution of the disease to become a risk factor for coronary artery disease. Severe periodontitis has been reported to be associated with a greater thickness of the muscle layer of the coronary artery supporting the role played by the pathogenesis of periodontitis in the formation of atheroma and subsequent acute myocardial infarction.

Advanced periodontitis is characterized by the production of acute episodes of bacteremia.
that alongside with other factors, can trigger ischemic events. Some authors have supported the systemic administration of antibiotics in patients with coronary artery disease in order to reduce the risk of these bacterial-induced ischemic episodes.

Destefan, et al. reported a 25% increase in risk for future coronary heart disease in association with PD after adjustment for traditional risk factors.

Similarly, Beck, et al. reported an odd ratio of 1.5 for any future coronary events and odds for an ischemic stroke among individual with less than 24 teeth compared with subjects with more than 24 teeth during 12 years follow up.

Destruction of the alveolar bone and supporting structures surrounding the teeth with the formation of significant pockets (>3 mm) is a prolonged process involving a chronically local gram negative infection and a profound local inflammatory response. Gradual breakdown of the oral systemic barrier with ulceration of the pocket epithelium allows entry of locally produced inflammatory mediators and gram negative bacterial components into the systemic circulation.

The results of the present study suggest that with increasing severity of periodontitis there is a substantial risk for AMI. Our findings suggest that dentists and specialists in the treatment of periodontal disease have to identify patients at risk for AMI.

Acknowledgements

This work was financially supported by Vice Chancellor for Research of Shiraz University of Medical Sciences. The authors declare that they have no Conflicts of Interest.

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