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Oral Health Status and Acute Myocardial Infarction

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Summary:
Background:
Oral health is an integral part of general health and periodontal disease may contribute to destabilization of atherosclerotic plaque leading to acute coronary syndrome and myocardial infarction (MI).

Objective: To study the state of oral health status in patients with acute myocardial infarction (AMI) and to compare this with that of a provably healthy control group.

Patients and Methods: A total of 80 patients with AMI were studied for their oral health status included dental status, plaque, gingival inflammation, periodontal situation, and tooth loss. High sensitive C-reactive protein (CRP), and lipids levels including serum total cholesterol (TC), triacylglycerol (TAG), high density lipoprotein cholesterol (HDL-C), and low density lipoprotein cholesterol (LDL-C) were measured in these patients; their age range was (60-75) years and compared with 40 healthy controls.

Results: There was a significant increase in serum hs-CRP and all lipid profile except HDL-C which was significantly decreased in AMI patients as compared with the controls, ($P < 0.0001$). Also, several oral diseases such as periodontitis, gingival inflammation, and plaque besides missing teeth and crowns are seen among these patients.

Conclusions: It can be concluded that poor oral health status, especially periodontal disease may influence on the occurrence and clinical course of MI.

Keywords: Oral diseases, acute myocardial infarction, C-reactive protein.

Introduction:

Cardiovascular diseases (CVD) are the class of diseases that involve the heart or blood vessels [1]. It is now widely accepted that a major component of pathology in CVD and particularly in atherosclerosis involves multiple components of the innate and adaptive immune systems leading to an inflammatory response within the atheromatous lesion [2].

Evidence suggests a number of risk factors for heart diseases: age, gender, high blood pressure, hyperlipidemia, diabetes mellitus, tobacco smoking, excessive alcohol consumption, and sugar consumption [3]. Amongst other factors, inflammatory diseases of the periodontium, such as periodontal diseases, i.e. gingivitis and periodontitis, also come under consideration [4].

Gingival enlargement may be caused by a multitude of causes. The most common is chronic inflammatory gingival enlargement, when the gingivae are soft and discolored. This is caused by tissue edema and infective cellular infiltration caused by prolonged exposure to bacterial plaque [5]. Thus, several of the methods used in the prevention of gingivitis can also be used for the treatment of manifest gingivitis, such as scaling, root planing, curettage, mouth washes containing chlorhexidine or hydrogen peroxide, and flossing [6].

Periodontitis has been linked in those over 60 years of age to impairments in delayed memory and calculation abilities [7]. Although periodontitis is a chronic infection, acute-phase elements are also involved in this immunological response and confirm that in periodontitis a systemic inflammation is present [8]. These acute-phase reactants have pro-inflammatory properties; they help to neutralize invasive pathogens and stimulate repair and regeneration of tissues [9].

C-reactive protein (CRP) is a more sensitive and accurate reflection of the acute phase response than the erythrocyte sedimentation rate (ESR) [10].

Moreover, a large prospective study in Sweden showed a close relationship between number of missing teeth and cardiovascular, coronary heart diseases (CHD) and even cardiovascular mortality, indicating a link between coronary artery disease and oral health [11].

Several studies indicate that serum concentrations of potentially inflammatory lipids, including low density lipoprotein cholesterol (LDL-C), triacylglycerol (TAG) and very low density lipoprotein (VLDL) are elevated in periodontitis patients. These lipid sub-forms may more easily enter the blood vessel wall, may be more susceptible to modification and therefore more likely to be incorporated in to the atherosclerotic lesion [12].

Aim of study:

The aim of the present study was to find the association between oral diseases and CVD in serum of AMI patients and compared that with healthy individuals.

Patients and Methods:

Eighty patients with AMI who attended to the Iraqi Center for Cardiovascular Diseases took part in the study. The study involved 45 men and 35 women; their age range was (60-75) and they were compared with 40 healthy controls. This study was done during the period from August 2013 until the end of January 2014. The dental investigation consisted of the dental status, plaque, gingival inflammation, periodontal situation, and tooth loss.

Measurements:

-Anthropometric Assessments:

Blood pressures were recorded according to the guidelines adopted by WHO and body mass index (BMI) was calculated by dividing subjects weight (Kg) by their height (m^2). BMI calculated as: BMI= mass (kg)/(height (m))^2 . Obesity was defined as BMI $\geq$ 30 Kg/m^2 [13].

-Laboratory Examinations:

High sensitive CRP (hs-CRP) assay employs the quantitative sandwich enzyme immunoassay technique [14]. Serum TC was measured by cholesterol kit, using an enzymatic method [15]. Serum TAG was measured by TAG kit, using an enzymatic method [16]. Serum HDL-C was measured by HDL-C kit, using an enzymatic method [17], and LDL-C was calculated indirectly by using the Friedewald's equation [18].

Statistical Analysis:

All the statistical work and registration of obtained data were carried out by using Microsoft office excel 2010 work sheet. Data were expressed as means (±standard deviation [SD]). Differences considered of statistical significance according to the t-test at $P < 0.05$.

Results:

Clinical characteristics of mean values in the examined groups are shown in table (1). There was a significant increase in age, BMI, systolic blood pressure (SBP), diastolic blood pressure (DBP), number of missing teeth, and number of crowns in AMI patients as compared with the controls. Based on analysis of variance in table (2), serum hs-CRP, TC, TAG, HDL-C, LDL-C, and VLDL were significantly higher in AMI patients than in the control group, (P=0.0001).

Table (1): Clinical characteristics of means values in the examined groups

Parameter	AMI	Control	P Value
Number	80	40	-
Age (years)	64.0 ± 10.5	52.5 ± 5.5	0.0001
Gender (Male/Female)	45/35	20/20	-
BMI (kg/m²)	30.50 ± 0.75	22.70 ± 0.23	0.001
SBP (mm Hg)	138.25 ± 8.5	120.30 ± 0.22	0.001
DBP (mm Hg)	89.30 ± 3.3	80.50 ± 0.26	0.001
Smoker (%)	65%	-	-
Periodontal diseases n. (%)	86%	-	-
Plaque n. (%)	67%	20%	-
Gingival inflammation n. (%)	73%	10%	-
No. of missing teeth	9.0 ± 6.5	2.5 ± 2.6	0.001
No. of crowns	6.8 ± 4.2	2.6 ± 1.2	0.001

Table (2): Biochemical characteristics of AMI group and controls (means ± SD)

Clinical Data	AMI	Control	P Value
hs-CRP (ng/ml)	15.0 ± 16.5	0.5 ± 2.1	0.0001
TC (mg/dl)	265.07 ± 3.12	152.91 ± 2.15	0.0001
TAG (mg/dl)	200.50 ± 2.05	96.03 ± 6.02	0.0001
HDL-C (mg/dl)	33.50 ± 1.67	65.17 ± 0.97	0.0001
LDL-C (mg/dl)	191.47 ± 28.42	68.54 ± 3.05	0.0001
VLDL-C (mg/dl)	40.1 ± 2.60	19.20 ± 1.20	0.0001

Discussion:

A possible link between oral health and CVD was reported [19]. Microbial plaque has been identified as the main cause of periodontal and dental disease. Some studies linked oral disease to CVD through some reaction which could also happen with mouth diseases [20, 21]. These studies showed that microbial plaque, induced periodontal diseases, and dental infection could initiate an inflammatory response which could act as a risk factor for cardiac events. It is very important in this study as 67% of the study subjects had visible plaque on their teeth which could put them on a higher risk for inflammation and cardiac events.

There is an association between CVD (arteriosclerosis) and periodontitis diseases [22]. There have also been an increasing number of reports of an association between periodontal inflammation and AMI [23].

Pertinent to periodontal diseases and their putative impact on CVD, serum CRP concentration has been proposed to be a risk marker for CVD and its serum levels are elevated in patients with periodontitis. However, the validity of serum CRP measurements as a risk predictor for atherosclerosis, and even its pathologic role in the development or progression of disease is controversial [24].

In a meta-analysis of 20 studies involving 1,466 patients with coronary artery disease, CRP levels were found to be reduced after exercise interventions. Among those studies, higher CRP concentrations or poorer lipid profiles before beginning exercise were associated with greater reductions in CRP [25].

In this study, it was stated that, compared to the healthy subjects, the level of hs-CRP was significantly higher in patients with AMI or with periodontitis as compared with the control group, table (2).

Periodontal diseases, including gingivitis and chronic periodontitis, are serious infections that, left untreated, can lead to tooth loss. Periodontal disease has been proposed to affect at least one tooth in 80% of adults worldwide [26]. In the present study, the numbers of missing teeth were greater than 9 in AMI patients' verses 2 or 3 in the control group.

In Holmlund's et al work in 2010, the mortality caused by CHD and CVD was predictable from the number of remaining teeth in which people with ten or fewer teeth were seven times at more risk of death caused by CHD than the ones with twenty five or more teeth [27]. Tobacco smoking is one of the risk factors for both periodontitis and CAD [28], which is in agreement with the present results, table (1).

The findings of Hokamura et al. indicated a possible mechanism by which P. gingivalis causes atherosclerosis in the blood stream. Furthermore, this study demonstrated novel cholesterol independent mechanisms that are involved in the formation of vascular diseases associated with P. gingivalis [29].

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