ASSOCIATION BETWEEN ORAL HEALTH AND ACUTE CORONARY SYNDROME IN ELDERLY PEOPLE

Liliana N. Nicolosi[1,2], Pablo G. Lewin[1], Nidia González[1], Lilian Jara[1], Anabel Lama[1], María del C. Rubio[1,2]

[1]Department of Buccodental Pathology. School of Dentistry. University of Buenos Aires.
[2]Cardiology Division, Spanish Hospital. Buenos Aires, Argentina.

ABSTRACT

With the aim of contributing information to help clarify the association between oral health, periodontal disease and ischemic cardiomyopathy, a comparative study was performed on hospitalized patients with and without acute coronary syndrome (ACS), evaluating atherogenic risk factors (ARF), level of oral hygiene and dental and periodontal health status. The study included patients in the coronary unit with ACS and patients in regular floor bed without evidence of cardiovascular pathology at Hospital Español, Buenos Aires, Argentina. The following ARFs were analyzed for all patients: hypertension, cholesterol, diabetes, obesity and smoking. The clinical dental examination included recording dental charts and variables related to oral hygiene, epidemiological indices and diagnosis of periodontal disease. The data collected were used to compare the ACS Group to the Control Group regarding prevalence of the ARFs and clinical dental variables studied. A total of 146 patients were studied: 81 male and 65 female, with average age 69.8±10.14 years. Prevalence of hypercholesterolemia was found to be significantly higher in patients in the ACS group than in the control group (p=0.043). The other ARFs considered did not differ. The levels of oral hygiene were similar in both study groups. The prevalence of decayed and filled teeth was similar in both groups, although there was a significantly higher number of missing teeth in the ACS group (p< 0.001). Patients with ACS had more severe periodontal disease and higher levels of gingival inflammation than the control group (p<0.001).

Conclusion: Oral health of patients with ACS was worse than oral health of patients without cardiovascular disease. The difference was shown by greater severity of periodontal disease in patients with ACS even though the level of oral hygiene was similar in both groups.

Key words: acute coronary syndrome, cardiovascular disease, oral health, periodontal disease

ASOCIACIÓN ENTRE SALUD BUCAL Y SÍNDROME CORONARIO AGUDO EN LA POBLACIÓN AÑOSA

RESUMEN

Con el objetivo de aportar información que permita esclarecer la relación entre la salud bucal, la enfermedad periodontal y la cardiopatía isquémica, se efectuó un estudio comparativo en pacientes internados con y sin síndrome coronario agudo (SCA) evaluando factores de riesgo aterogénicos (FRA), nivel de higiene bucal, estado de salud dental y periodontal. Se incorporaron al estudio pacientes internados en unidad coronaria con SCA y pacientes internados en sala general sin evidencia de patología cardiovascular del Hospital Español, Buenos Aires, Argentina. En todos los pacientes se consignaron los FRA: hipertensión arterial, colesterol, diabetes, obesidad y tabaquismo. En el examen clínico odontológico se registró: odontograma, variables relacionadas con la higiene bucal, se confeccionaron índices epidemiológicos y se realizó el diagnóstico del cuadro periodontal. Con los datos recolectados, se realizó un examen comparativo entre los dos grupos de estudio (Grupo con SCA vs Grupo Control) respecto a la prevalencia de los FRA y las variables clínicas odontológicas estudiadas. Se estudiaron 146 pacientes, 81 hombres - 65 mujeres, con promedio de edad de 69.8±10.14 años. Se observó que la prevalencia de hipercolesterolemia fue significativamente mayor en los pacientes del grupo SCA respecto a los controles (p=0.043). Los restantes FRA considerados no mostraron diferencias. Los niveles de higiene bucal fueron semejantes entre ambos grupos de estudio. El grupo SCA tuvo similar prevalencia de caries y restauraciones respecto al grupo Control, sin embargo, perdieron significativamente más piezas dentarias (p<0.001). Los enfermos con SCA tuvieron cuadros periodontales más severos y niveles de inflamación gingival superiores en comparación con el grupo control (p<0.001).

Conclusión: El estado de salud bucal de los pacientes con SCA fue peor respecto de aquellos pacientes que no presentaban enfermedad cardiovascular. La diferencia se objetivó en una mayor severidad de la enfermedad periodontal en pacientes con SCA a pesar de observarse niveles de higiene similares entre ambos grupos.

Palabras clave: síndrome coronario agudo, enfermedad cardiovascular, salud bucal, enfermedad periodontal.

INTRODUCTION

Research was conducted into whether there is a causal relationship between periodontal disease (POD) and cardiovascular disease (CVD), and whether POD is an independent risk factor or both diseases share etiological factors [1-6].

This interest arises from the high prevalence of the two diseases. POD is one of the most frequent chronic infections in humans[7], and if a significant association were found between it and CVD, it would have major implications for public health[8], since POD is preventable and treatable.

POD is a chronic infectious pathology that generates an inflammatory response of multifactorial etiology[9,10]. Evidence has been found showing that atherosclerosis, the main cause of CVD, is also an inflammatory disease[11-19]. In its pathogenesis, a variety of mechanisms interact with multiple risk factors to initiate, spread and activate arterial lesions[20]. Factors of metabolic origin, such as diabetes, hypercholesterolemia, obesity[21-25], hypertension[26-27], infectious factors such as *Chlamydia pneumoniae*, *Citomegalovirus*, among others[28-30], and smoking, have been identified as risk factors[31].

Atherosclerosis is a complex process involving many cell types (monocytes, macrophages, T lymphocytes, smooth muscle and endothelial cells) and inflammatory factors such as C-reactive protein, interleukins, tumor necrosis factor and prostaglandins, among others[32-34].

During the progression of the disease the atheromatous plaque may rupture, generating an acute vascular event. This plaque accident is determined by an inflammatory phenomenon that may be quantified by determining acute phase reactants in the serum of patients with acute coronary syndrome (ACS)[35-37].

It could be asked whether an infectious pathology could trigger an inflammatory process capable of generating an acute vascular event, or whether it is the atheromatous plaque being colonized by germs isolated in the periodontal tissue (as has been proven) that determines the progression of the disease and/or atheromatous plaque disruption[38-41].

Despite the many efforts to relate atherosclerotic disease to POD, there is no conclusive evidence showing it to be an independent risk factor for CVD[42].

With the aim of contributing information that would help clarify whether there is a causal or coincidental relationship between POD and CVD, a comparative study was performed on hospitalized patients with and without ACS, evaluating ARF, oral hygiene and dental and periodontal health status.

Aim**:** To estimate whether there are any differences in the atherogenic risk factors, oral hygiene, dental and periodontal health between patients with and without acute coronary syndrome.

MATERIALS AND METHODS

This is a comparative, observational, transversal study, performed from March 2009 to September 2010. 146 patients of both sexes hospitalized in Hospital Español, in Buenos Aires, Argentina were included consecutively. The sample was divided into two groups:

Group with ACS: patients with ACS in the coronary unit.

Control Group: patients in regular floor bed hospitalized for different pathologies, without clinical evidence of CVD.

Inclusion Criteria:

1. Patients of both sexes, over 18 years of age, who provided written informed consent to participate in the clinical study.
2. Patients with ACS hospitalized in the coronary unit without ST- segment elevation, defined as meeting at least two of the following criteria[43]:
   a) 1. Angina pain lasting over 20 minutes at rest.
      2. New on set (de novo) severe angina Class III according to the classification of the Canadian Cardiovascular Society[44].
      3. Recent destabilization of previously stable angina with features of angina class > III (CCS)[44].
   b) Changes in ST/T (ST depression ≥ 1 mm and/or inversion in T wave polarity) in at least two EKG contiguous leads.
   c) Rise in biomarkers (creatine kinase (CPK), CPK MB and troponin T).
3. Patients hospitalized in regular floor bed, without clinical evidence of CVD.

Exclusion criteria:

1. Totally edentulous patients
2. Acute infectious pathologies.
3. Antibiotic treatment during hospitalization and/or during the 3 months prior to hospitalization.
4. Hospitalization in regular floor bed for 7 days or longer.
5. Immunocompromised or oncological disease under chemotherapy or radiotherapy.

6. Major surgery within the last 3 months.
7. Patients unable to provide information on their dental hygiene habits at the interview.

ARFs were determined for all patients. Hypertension (HTN) was considered for values higher than 140/90 mmHg; hypercholesterolemia for LDL cholesterol >130mg/dl; diabetes for glycosylated hemoglobin (Hb A) 1c > 6.1 mg/dl; obesity for body mass index > 30 and smoker for subjects who had regularly smoked at least one cigarette per day during the last year[45]. Smokers were also grouped according to the number of cigarettes smoked per day (1 to 10, 11 to 15, 16 to 20 and more than 20 cigarettes per day).

One specially calibrated operator performed all the clinical dental examinations (intra-observer kappa factor, k=0.78). A dental chart was made for each patient showing missing, filled and decayed teeth. Third molars were not included as they are not constant or are prematurely lost due to pathologies of their own. Clinical diagnosis of dental caries was done by direct visual inspection and instrumentation with a fine dental explorer (Nº 5 – Hu-Friedy co.) based on dental caries differential diagnosis criteria[46]. Data from the dental chart were used to calculate the DMFT index[47]. Patients were interviewed to record frequency and methods of oral hygiene. The effectiveness of oral hygiene was assessed using the Löe and Silness plaque index (PLI)[48]. Periodontal health was assessed by means of the Löe and Silness gingival index (GI)[48] and periodontal probing. Periodontal probing was done manually with Marquis-type dental probes (Hu-Friedy, co.) on all teeth. Four sites per tooth were probed (V, L/P, D and M). Probing depth (PD) and clinical attachment loss (CAL) were measured at each inspected site. Each patient's periodontal index (PI) was calculated according to the average CAL in all probed sites, using the criteria proposed at the AAP International Workshop for a Classification of Periodontal Disease and Conditions – 1999 [49] listed below:

- CAL < 1 mm: Without periodontitis.
- CAL from 1 to 2 mm: Mild periodontitis.
- CAL from 3 to 4 mm: Moderate periodontitis.
- CAL ≥ 5 mm: Severe periodontitis.

Patients without POD were classified as PI = 0; patients with mild periodontitis were classified as PI = 1; moderate PI = 2 and severe PI = 3.

Since most patients with coronary disease were receiving double antiaggregation and anticoagulation therapy, it was decided that bleeding on probing would not be assessed for any of the patients.

The data collected were used to perform a comparative examination between the two study groups regarding prevalence of the ARFs, oral hygiene levels and dental and periodontal health. Proportions were compared using chi-square, Fisher and Student t tests.

RESULTS

A total 203 patients were evaluated, and 146 were included (81 male and 65 female), average age 69.8±10.14 years. They were divided into two groups: Group with ACS: hospitalized patients diagnosed with ACS (n=73, mean age= 69.52±10.81 years, 43.84% female, 56.16% male) and Control Group, patients hospitalized in regular floor bed for various pathologies with no clinical evidence of cardiovascular disease (n=73, mean age =70.08±9.48 years, 45.21% female, 54.8% male). Both groups were similar in age (t= -0.33, p= 0.73) and gender (Chi^2 = 0.027- p = 0.86).

Table 1 shows that prevalence of hypercholesterolemia was significantly higher in the ACS Group (Chi^2=4.06, p=0.43). The other ARFs considered showed no difference.

Table 1: Distribution of prevalence of atherogenic risk factors in the sample.

Risk Factor	ACS Group (% prevalence)	Control Group (% prevalence)	Statistical Significance
Obesity	4.3	1.4	Chi^2= 1.11 p= 0.29
Hypercholesterolemia	49.3	32.4	Chi^2= 4.06 p= 0.043*
Diabetes 1	0	1.4	Chi^2= 1.06 p= 0.58
Diabetes 2	23.9	21.1	Chi^2= 1.06 p= 0.58
Hypertension	71.6	63.4	Chi^2= 1.07 p= 0.30
Male sex	56.2	54.8	Chi^2= 0.02 p= 0.86

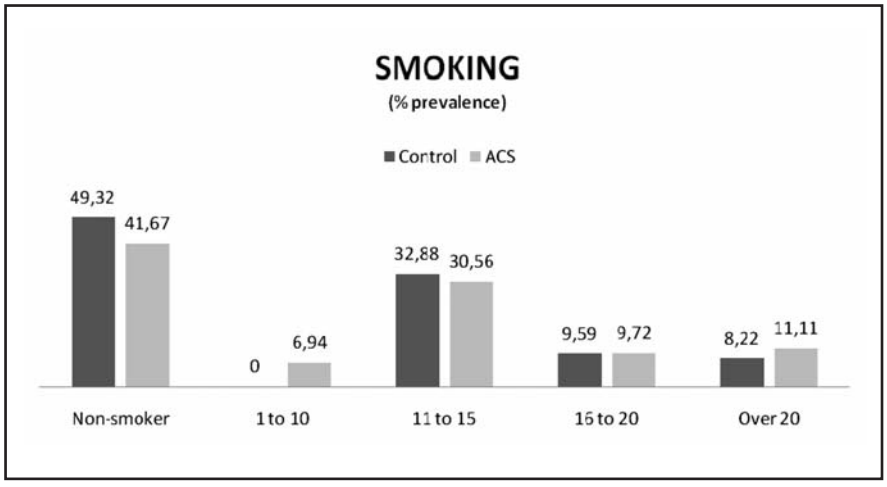

Fig. 1: Prevalence of smoking in the study sample.

Fig. 1 analyzes the smoking variable, showing that there was no significant difference between study groups, Chi^2= 5.91, p= 0.20.

Tables 2 and 3 show that oral hygiene levels were similar in frequency and methods.

The similarity between study groups regarding effectiveness of oral hygiene is shown by the similarity in the values for bacterial plaque index (Table 4).

Table 5 shows that total DMFT index differs significantly between coronary patients and control patients (F= 41.43, p < 0.001). However, a breakdown of DMFT shows that patients in the ACS Group had similar prevalence of decays and fillings as the patients in control group, although they had a significantly higher number of missing teeth (16.36±7.57 vs. 9.19±7.25, p < 0.001).

Patients with ACS had more severe PI (F= 23.96, p < 0.001), higher values for PD (F= 63.91, p < 0.001) and their average GI was higher than in the control group (F= 97.861, p < 0.001) (Table 6).

Table 2: Dental hygiene cleaning methods.

Cleaning methods	SCA Group (% prevalence)	Control Group (% prevalence)	Statistical Significance
None	0	1.3	
Toothbrush	5.4	2.7	
Toothbrush + toothpaste	86.3	90.4	Chi^2= 3.73 p= 0.44
Toothbrush + toothpaste + dental floss	0	1.3	
Toothbrush + toothpaste + dental floss + mouth-rinse	8.22	4.11	

Table 3: Analysis of daily frequency of oral hygiene.

Frequency of daily cleaning	SCA Group (% of cases)	Control Group (% of cases)	Statistical Significance
Once	21.9	22.2	
Twice	65.8	65.3	Chi^2= 2.25
Three times	12.3	9.7	p= 0.52
More than three times	0.0	2.8	

Table 4: Comparison of bacterial plaque index (PLI) between study groups.

Group	Plaque Index (mean value)	Statistical Significance
ACS Group	2.76 ± 0.46	F= 1.764 – p=0.18
Control Group	2.62 ± 0.59	

Table 5: Comparison between study groups of mean values for total DMFT index and breakdown.

Group	Decayed teeth	Missing teeth	Filled teeth	Total DMFT
ACS Group	1.79 ± 2.31	16.36 ± 7.57	2.45 ± 3.06	20.6 ± 12.94
Control Group	1.76 ± 2.57	9.19 ± 7.25	2.15 ± 3.2	13.1 ± 13.06
Significance	p = 0.94	p < 0.001*	p = 0.56	p < 0.001*

Table 6: Comparative analysis of the periodontal index (PI) and gingival index (GI) between study groups.

Group	Periodontal Index (mean value)	Probing Depth (mean value in mm)	Gingival Index (mean value)
ACS Group	2.57 ± 0.66	4.23 ± 0.87	2.76 ± 0.49
Control Group	1.8 ± 1.0	2.39 ± 0.52	1.62 ± 0.83
Significance	F = 23.96 – p < 0.001*	F= 63.91 – p < 0.001*	F = 97.86 – p < 0.001*

DISCUSSION

Different studies seem to support a weak association between POD and CVD[50-52], in spite of which it has so far not been possible to determine whether POD is an independent risk factor for CVD, because both diseases share common predisposing factors, which might create a pathophysiological link without there necessarily being a causal relationship, and it would be possible to suggest a common phenotype and even a genetic predisposition to suffer from both pathologies.

Our research has recorded parameters of oral health, dental hygiene and Framingham's ARF index in patients with atherosclerosis acutely involving the coronary arteries due to the instability of an atheromatous plaque. This creates myocardial ischemia giving rise to ACS, therefore the analysis of the results obtained correspond to a cross section in the evolution of atherosclerosis. The same is true of oral health, since the state prior to the acute event was unknown.

Due to the fact that hospitalized patients might change their oral hygiene, and this one of the parameters used, the control group was made up of patients hospitalized for other reasons, without evidence of cardiomyopathy.

There was no difference in ARFs between the ACS and control groups, probable because the patients were elderly and there was high prevalence of HTN and DBT in both groups. However, there were significant differences regarding cholesterol values, which were, as expected, higher in patients with ischemic cardiomyopathy.

Patients with ACS were found to differ significantly in the severity of POD, shown by significantly higher PI, PD and GI in coronary patients, in addition to greater number of missing teeth. Number of missing teeth was independent of the level of oral hygiene, which was similar, as was PLI.

The differences may be due to a greater inflammatory response in patients with ACS, because comparable microbial loads in both groups showed more severe periodontal disease.

It's possible the gingival inflammatory process could trigger or contribute to a systemic inflammatory process capable of destabilizing an atheromatous plaque, the pathophysiological substrate for ACS.

Prospective studies including a large number of cases and long-term monitoring will be needed to determine any kind of joint cause, causality or coincidence between cardiovascular pathology and POD.

CONCLUSION

Oral health of patients with ACS was worse than patients without cardiovascular disease. The difference was shown by the greater severity of the periodontal disease despite similar levels of hygiene in both groups.

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CORRESPONDENCE

Prof. MD Liliana N. Nicolosi
Facultad de Odontología
Marcelo T. de Alvear 2142 – 4to A, Buenos Aires, Argentina
lnicolosi@hotmail.com
postmast@pcbd1.odon.uba.ar

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