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ORIGINAL ARTICLE

Inpatients days in patients with respiratory diseases and periodontal disease

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Abstract

Introduction: *Periodontal disease is a chronic inflammatory gingival process that has been associated with the severity of respiratory diseases. In Mexico a prevalence of 78% was found in population with social security and > 60 years old. The aim of this study is to establish the association between periodontal disease and respiratory diseases according to the inpatient days.* **Material and methods:** *A cross-sectional study was conducted from January to December 2011. We included hospitalized patients, ≥ 18 years of age, without sedation or intubated. A dentist classified patients into two groups according to the severity of the periodontal disease: mild-to-moderate and severe. We estimated medians of inpatient days by disease and severity. Negative binomial models were adjusted to estimate incidence rate ratios and predicted inpatient days.* **Results:** *3,059 patients were enrolled. The median of observed and predicted inpatient days was higher in the group of severe periodontal disease ($p < 0.05$). Patients with chronic obstructive pulmonary disease, tuberculosis, and influenza had the highest incidence rates ratios of periodontal disease ($p < 0.05$).* **Conclusions:** *The severity of periodontal disease is positively associated with inpatient days of patients with respiratory diseases.* (Gac Med Mex. 2017;153:28-32)

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Introduction

Periodontal disease (PD) is a gingival inflammatory chronic process that leads to the destruction of teeth-supporting structures and alveolar bone, and subsequently to the loss of teeth due to bacterial infection. PD increases the risk to suffer systemic diseases, and specifically respiratory infections[1-3]. The association between respiratory infections (RI) and PD has been explained in terms that PD implies chronic aspiration of oropharyngeal bacteria to the lower airways[2]. Several studies have been reported where the association between PD and bacterial pneumonia, bronchitis COPD and pulmonary abscess is shown[4-6].

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As for studies on PD prevalence, there are several in the world with different types of study populations, but there are few conducted in hospital populations. A prevalence of periodontal pockets of 47% was found in inpatients of an Indian psychiatric hospital[7]. In the hospital setting, establishing interventions favoring oral health has been shown to decrease the presence of signs and symptoms of respiratory disease (RD)[8,9].

In Mexico, a PD prevalence of 78% was found in 60-year old or older people who had social security service and attended their health unit as outpatients[10]. On the other hand, data on oral health and frailty have been reported on elderly subjects of Mexico City[11]. In this context, the purpose of our study was to determine the association between PD and RD as assessed by hospitalization days (HD) in patients admitted to a RD referral center in Mexico City.

Materials and methods

Type of study and study population

A hospital-based cross-sectional study was carried out, the study population of which were hospitalized patients at the National Institute of Respiratory Diseases (INER – *Instituto Nacional de Enfermedades Respiratorias*) Ismael Cosío Villegas from January to December 2011.

The INER has a stomatology department that offers consultation and systematically performs oral examinations to hospitalized patients. The examination was carried out by a dentist specialized in dental rehabilitation, staff member of the stomatology department, who was in charge of oral examination and PD classification in all patients of the study. All hospitalized adult patients (age ≥ 18 years) were included, except for those who were sedated or intubated.

Two PD groups were identified: 1) mild to moderate PD (MMPD) and 2) serious PD (SPD). SPD was defined when one or more of the following signs were observed on examination: 1) serious oral damage due to inflammation, 2) gum reddening, 3) bleeding, 4) pain, 5) fractured dental pieces, 6) bone loss, 7) dental mobility and/or 8) partial edentulism. The rest of the patients were classified as MMPD.

RD codes and hospital stay

RD classification was made using the World Health Organization International Classification of Diseases 10th revision (ICD-10). The INER's statistics department keeps record of all hospital admissions and discharges. Based on that information, the HDs of patients included in the study were calculated.

Socioeconomic level

The INER's social work department is in charge to assign patients' socioeconomic level. According to the assigned socioeconomic level, the patient receives a subsidy percentage in the costs of the medical services offered by the institute. Socioeconomic level is a weighted index that takes the income by dependent (the factor with the highest weight), household characteristics (construction materials, public services available, if household location is urban, suburban or rural), if the person is owner of or rents the house, and the presence of other diseases in other members of the family into account. The socioeconomic level has 10 categories (from 0 to 9). Patients with the lowest socioeconomic level (level 0) do not pay any fee for the received medical services. As the level increases, the fee the patient has to pay is increased. Level 6 patients pay the real cost of the service for the INER. Finally, patients classified between levels 7 and 9 pay the real cost of the service plus an additional amount that represents a profit for the institute.

Statistical analysis

We estimated median HDs per disease stratifying by PD group. To estimate incidence rate ratios (IRR), we adjusted negative binomial models for each RD with the number HD being regarded as a dependent variable and PD as the main exposure variable. The models were adjusted for age, gender and socioeconomic level. To adjust for disease seriousness, we used mortality and diabetes mellitus as proxy variables. We obtained the HDs predicted by the models and, with Mann-Whitney U-test, we compared predicted days medians stratifying by PD category.

Results

A total of 3,059 hospital admissions of patients meeting the inclusion criteria were recorded. Of the recorded admissions, 57.5% were of males and median age (p25-p75) was 52 (36-66) years. Among all patients, 25.2% had SPD. Median HD (p25-p75) was 11 (6-20) days. The most prevalent disease was malignant tumors with 18.5%, while the least prevalent was pulmonary abscess with 1.4% (Table 1).

Median HDs observed for each RD stratified by PD seriousness are shown in table 2. In general, patients

Table 1. Patient clinical and socio-demographic characteristics

Variable	n (%)
Males	1,760 (57.5)
Age (years) (median [p25-p75])	52 (36-66)
Hospitalization days (median [p25-p75])	11 (6-20)
SPD	772 (25.2)
Diabetes mellitus	279 (9.1)
Mortality	384 (12.6)
Socioeconomic level	
0	644 (21.1)
1	850 (27.8)
2	831 (27.2)
3	518 (16.9)
4	216 (7.1)
COPD	241 (7.9)
Tuberculosis	182 (6.0)
Pneumonia and influenza	415 (13.6)
Pulmonary abscess	44 (1.4)
HIV	432 (14.1)
Malignant tumors	567 (18.5)
Interstitial pulmonary disease	364 (11.3)
Bronchiectasis	71 (2.3)
Pleural disease	255 (8.3)
Asthma	506 (16.5)

CPOD: chronic pulmonary obstructive disease; HIV: human immunodeficiency virus; SPD: serious periodontal disease.

with SPD spent more days hospitalized in comparison with patients with MMPD. All differences were statistically significant ($p < 0.05$). The largest difference was 28 days and it occurred in patients with tuberculosis and SPD, followed by the HDs of patients with pneumonia and influenza, with 11 days.

The results of the negative binomial models are shown in table 3. The highest IRR for PD was observed in patients with COPD (28.0; $p < 0.01$); patients with tuberculosis and influenza had the second and third highest IRR (2.46; $p < 0.01$ and 1.79; $p < 0.01$, respectively).

Figure 1 shows median HDs predicted by the negative binomial models stratified by PD seriousness. For all diseases, median HDs were higher in the SPD group and the differences were statistically significant ($p < 0.01$). Patients with COPD and tuberculosis showed the greatest differences in HDs, with 19 and 18.4 days, respectively.

Discussion

In general, we observed higher hospital stay in patients with RD and SPD in comparison with patients with MMPD. This was observed both for recorded mean values and for HD values predicted by the models; even after adjusting for seriousness proxy variables, the differences persist in both groups. Although the IRRs of patients with asthma and bronchiestasis were not significant, IRRs in the remaining diseases were > 1 and statistically significant. This confirmed that patients with oral health higher deterioration spend

Table 2. HDs by disease stratified by PD seriousness

Disease	MMPD, median (p25, p75)	SPD, median (p25, p75)	p
COPD	9 (6, 14)	13 (8, 40)	< 0.01
Tuberculosis	11 (7, 18)	39 (20, 44)	< 0.01
Pneumonia and influenza	10 (7, 18)	21 (15, 33)	< 0.01
Pulmonary abscess	13.5 (9, 20)	24 (22, 34)	< 0.05
HIV	11 (7, 19)	21 (12, 30)	< 0.01
Malignant tumors	13 (7, 20)	18 (13, 26)	< 0.01
Interstitial pulmonary disease	11 (7, 16)	14 (10, 27)	< 0.01
Bronchiectasis	9 (6, 12)	12.5 (9, 17)	< 0.05
Pleural disease	14 (9, 21)	18 (13, 34)	< 0.01
Asthma	5 (4, 7)	6.5 (5, 9)	< 0.05

CPOD: chronic pulmonary obstructive disease; HIV: human immunodeficiency virus; MMPD: mild or moderate periodontal disease; SPD: serious periodontal disease; PD: periodontal disease.

Table 3. IRR for PD seriousness according to RD

Disease	IRR* (95% CI)
COPD	2.80 (2.09-3.75)
Tuberculosis	2.46 (2.00-3.02)
Pneumonia and influenza	1.79 (1.52-2.10)
Pulmonary abscess	1.71 (1.33-2.19)
HIV	1.51 (1.30-1.75)
Malignant tumors	1.50 (1.31-1.70)
Interstitial	1.44 (1.19-1.74)
Bronchiestasis	1.52 (0.91-2.53)
Pleural disease	1.32 (1.12-1.55)
Asthma	1.12 (0.89-1.41)

*To obtain the IRRs we used the negative binomial model adjusting for age, gender, socioeconomic level, death and diabetes mellitus.
95% CI: 95% confidence interval; COPD: chronic obstructive pulmonary disease; IRR: incidence rate ratio; HIV: human immunodeficiency virus; RD: respiratory risease.

more days hospitalized. HDs can be nearly up to 3-fold higher, as observed in patients with COPD. This result is consistent with other studies that find that patients with COPD and poor oral health have more exacerbations[12].

Patients who are hospitalized at the INER show poor oral health, which was observed because no patient was classified as being healthy from the oral point of view. Therefore, it is possible that INER patients have prolonged stays not only due to the seriousness of their condition, but also due to respiratory health and oral health interaction. A study in Japan showed that establishing a once-weekly teeth cleaning program for 24 months reduced the incidence of fever and cases of fatal pneumonia in a group of elderly subjects living in an old people's home[13]. It might be suggested that establishing an oral hygiene program with the purpose to minimize the effect of poor oral health during respiratory patients' hospital stay would not only help faster patient recovery, but also to reduce hospital stay and hence INER hospitalization costs.

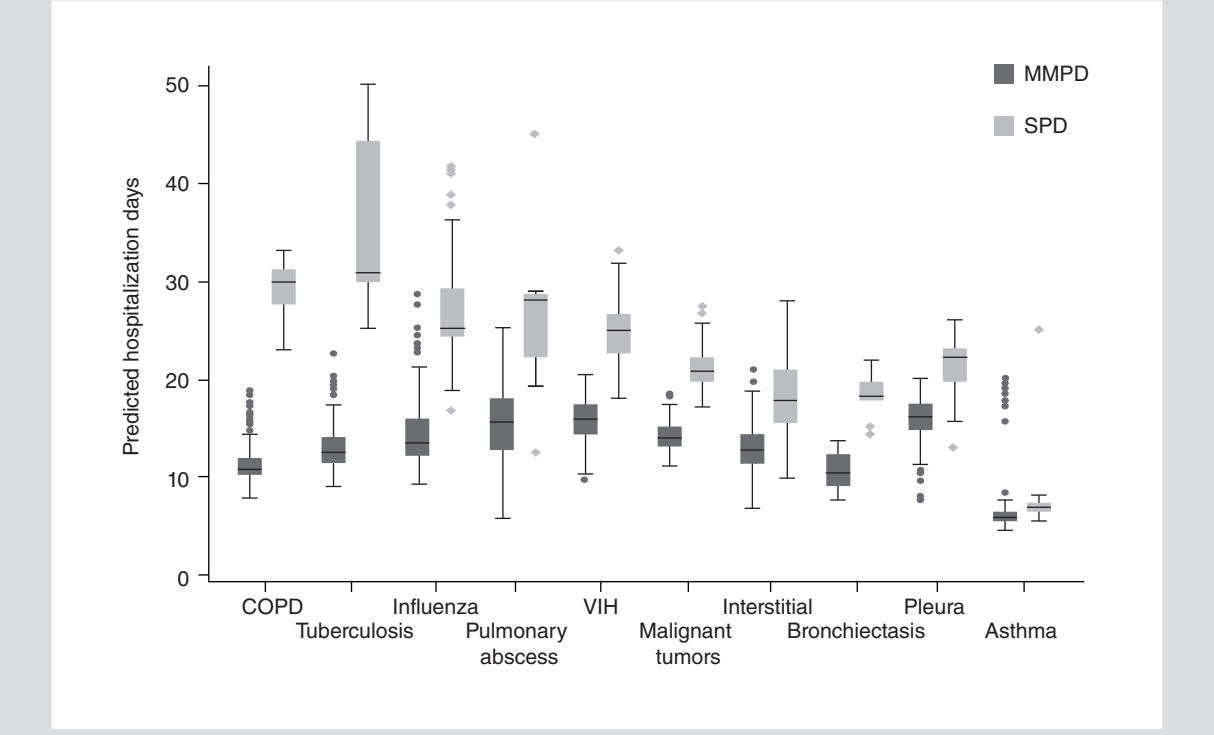

Figure 1. *Predicted hospitalization days per disease stratified by periodontal disease seriousness. Predicted hospitalization days were obtained from negative binomial models adjusted for age, gender, socioeconomic level, death and diabetes mellitus. MMPD: mild to moderate periodontal disease; SPD: serious periodontal disease; COPD: chronic obstructive disease; HIV: human immunodeficiency virus.*

Study limitations

The main limitation of this study was the way to diagnose PD. Patients' oral examination could only be visually performed by the specialist since patients cannot be intervened in this area unless the treating physician requests it, and data on indices was therefore not available. However, visual evidence was notorious, and damage characteristics reflected long-standing oral hygiene neglect. Another inherent limitation is the study cross-sectional design, where we simultaneously assessed PD and RD, and for this reason we are unable to establish which one occurred first. However, the main strength of the study is that we included all consecutively hospitalized patients during the year of study, including for the first time an analysis of all acute and chronic RDs and their association with RD.

Conclusions

The results suggest a positive relationship between PD seriousness and RD. Conducting studies where an oral health-improving intervention is carried out is recommended in order to show if it reduces RD seriousness.

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