



Original Article

Relationship between Periodontal Diseases and Essential Hypertension: A Cross-Sectional Comparative Study

Association entre maladies parodontales et hypertension essentielle: une étude comparative.

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ABSTRACT

Background. Periodontal disease is a multifactorial inflammatory disease affecting the support tissues of the teeth. Numerous studies have investigated the relationship between oral diseases and Essential Hypertension. There is a paucity of data on the relationship between periodontal disease and essential hypertension in Cameroon. **Methods.** We carried this cross-sectional comparative study in adults ≥ 21 years, of both sex. Participants were hypertensive (test group), and non-hypertensive (comparison group). The different periodontal indices (plaque index, bleeding index, loss of attachment) were measured during the periodontal examination. Student's test, Chi-square test, and linear regression models were used in the statistical analyses. **Results.** A total of 80 participants (40 hypertensives and 40 controls) were enrolled. Their mean ages were 53.3 ± 11.4 years and 42.8 ± 8.2 years respectively. Mean plaque index was 1.54 ± 0.7 in the hypertensives, and 1.36 ± 0.5 in non-hypertensives ($p < 0.05$). Mean bleeding index was 1.88 ± 0.3 in hypertensives and 1.38 ± 0.4 in non-hypertensives ($p < 0.05$). Mean attachment loss was 1.58 ± 0.22 in hypertensive patients and 1.26 ± 0.27 in controls with $p < 0.05$. **Conclusion.** Our studies suggest a link between periodontal disease and essential hypertension. Further studies matching the control group in confounding variables are mandatory because of the significant difference in age between the two groups.

RÉSUMÉ

Introduction. La parodontite est une pathologie inflammatoire multifactorielle affectant les tissus de soutien de la dent. De nombreuses études se sont penchées sur les rapports entre les maladies bucco-dentaires et. Au Cameroun, peu d'études ont examiné la relation entre la maladie parodontale et l'Hypertension artérielle essentielle. **Méthodes.** Il s'agit d'une étude transversale comparant un groupe patients (les hypertendus), et un groupe contrôle constitué de patients sans Hypertension. Tous avaient un âge au moins égal à 21 ans. Les différents indices parodontaux (indice de plaque, de saignement, perte d'attache) ont été mesurés au cours de l'examen parodontal. Le test de Student, le test de Chi-carré et les modèles de régression linéaire ont été utilisés pour les analyses statistiques. **Résultats.** La population d'étude était constituée de 80 sujets repartis en deux groupes de 40 sujets chacun: un groupe d'étude (hypertendus) et un groupe contrôle de 40 patients. L'âge moyen de la population d'étude était respectivement de $53,28 \text{ ans} \pm 11,4$ chez les hypertendus et de $42,8 \text{ ans} \pm 8,2$ chez les contrôles. L'indice de plaque moyen était plus élevé chez les hypertendus $1,54 \pm 0,69$ contre $1,36 \pm 0,51$ chez les contrôles ($p < 0,05$). L'indice de saignement moyen lui aussi était plus élevé pour les hypertendus $1,88 \pm 0,34$ contre $1,38 \pm 0,42$ pour les contrôles ($p < 0,05$). La perte d'attache moyenne était de $1,58 \pm 0,22$ chez les hypertendus et de $1,26 \pm 0,27$ chez les contrôles avec $p < 0,05$. **Conclusion.** Nos résultats suggèrent l'existence d'un lien entre la MP et l'Hypertension essentielle. Toutefois, la différence d'âge entre les groupes est notable, des études complémentaires avec appariement du groupe contrôle au groupe d'étude sont nécessaires.

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INTRODUCTION

Periodontal disease (PD) is a multifactorial inflammatory disease affecting the support tissues of the teeth. It is characterized by the progressive destruction of the periodontal tissues resulting in the loss of the dental organ [1]. The World Health Organization (WHO) estimated that 15 to 20% of the population have severe PD [2]. The prevalence of PD in Africa is one of the highest in the world [3]. There are many risk factors that allow each individual to react differently such as; smoking, alcohol, stress, poor nutrition, obesity, diabetes mellitus, and dyslipidemia. These are also risk factors for cardiovascular diseases (CVD), a public health problem worldwide accounting for 17.3 million deaths yearly, of which 9.4 million are attributed to hypertension [4, 5]. Hypertension has reached epidemic proportions, with greatest burden in low-income settings in sub-Saharan Africa (SSA) [5]. It affects about 30% of the population of Cameroon [6]. Numerous studies have examined the relationship between oral diseases and cardiovascular disease [7]. Studies have suggested a link between periodontal disease and hypertension. In Italy in 2003, a study of the relationship between the severity of periodontitis and left ventricular mass in subjects with essential hypertension reveals a direct link between PD and hypertension [8].

There is a paucity of data on the association of periodontal disease and hypertension in our setting. These pathologies directly affect the quality of life, and have a considerable impact on the well-being of the individual [2, 9]. The aim of this cross-section comparative study was to investigate the association of periodontal disease and hypertension in Yaounde.

METHODS

Study design and setting: In 2017, we carried out a cross-sectional comparative study in the Internal medicine units of the Yaounde University Teaching Hospital, and the Yaounde central Hospital. Yaounde is the political capital of Cameroon, with a population of about 2 million inhabitants.

Participants: These were consenting adults aged ≥ 21 years, of both sex, with newly diagnosed and untreated hypertension (test group), and without hypertension (comparator group). We excluded those with other heart conditions, thyroid diseases, chronic kidney disease, respiratory disorders, rheumatic disorders, diabetes, tobacco users, and pregnant women. We also excluded those with less than 50% of their teeth, or had undergone dental cleaning within the last 6 months.

Variables and measurements: We prospectively collected data on socio-demography (age and sex), past medical history, and anthropometry (weight and height). Their weight (kg) was measured in light clothing and no shoes on using an electronic scale balance (OMRON® HN289), and their height (m) with a stadiometer. We calculated their Body Mass Index (BMI) as their weight / (height)². High adiposity was considered when the BMI was ≥ 25 kg/m². We measured their blood pressure (BP) after at least 10 minutes of rest in the sitting position in

both arms with a standard sized cuff, using an electronic BP recorder (OMRON® M2 Basic). Two measures were taken for each arm. The arm with the higher average was considered in diagnosing hypertension. We defined hypertension as a resting systolic BP > 140 mmHg, and or diastolic BP > 90 mmHg in untreated hypertensive patients. The various periodontal indices (plaque index, bleeding index and loss of attachment) were measured during the periodontal examination.

Statistical analysis: Data were analyzed using the software IBM SPSS version 20. Student t-test was used to compare the means, and Chi squared test was used to compare proportions. Linear logistic regression models were used to study the factors associated with hypertension. A p value < 0.05 was considered statistically significant for the observed associations or differences.

Ethical considerations: Ethical clearance for this work was obtained from the institutional review board of the Faculty of medicine and Biomedical sciences of the University of Yaounde 1. We report this work in accordances with the declarations of Helsinki. We report this work following the STROBE checklist.

Results

Participants: A total of 80 participants (40 hypertensives and 40 normotensives) were included. There were 16 (40%) males in the hypertension group, and 11 (27.5%) males in the normotensive group. Their mean age was 53.3 ± 11.4 years in the hypertensive group, and 42.8 ± 8.2 years in the normotensive group (Table I).

Table I: Baseline characteristics of the study population.

Variables	Hypertensives (n=40)	Controls (n=40)	p value
Age (years), mean \pm SD	53.3 ± 11.4	42.8 ± 8.2	< 0.05
Male (%)	40	27.5	< 0.05
Alcohol (%)	37.5	40	0.49
Obesity (%)	27.5	10	< 0.05
Systolic blood pressure (mmHg)	162 ± 21	116 ± 13	< 0.05
Diastolic blood pressure (mmHg)	93 ± 11	75 ± 8	< 0.05
Family history of Hypertension (%)	72.5	42.5	0.06
Plaque index	1.54 ± 0.7	1.36 ± 0.5	< 0.05
Bleeding index	1.88 ± 0.3	1.38 ± 0.4	< 0.05
Loss of attachment	1.58 ± 0.2	1.26 ± 0.3	< 0.05

Outcome data: The mean plaque index was 1.54 ± 0.7 in the hypertensive group, and 1.36 ± 0.5 in the normotensive group ($p < 0.05$). The mean bleeding index was 1.88 ± 0.3 in the hypertensives, and 1.38 ± 0.4 in the normotensives ($p < 0.05$) (Table II).

Table II shows a cross analysis of bleeding index and attachment loss as a function of plaque index average of between 1.25 – 1.5. This was to minimize the impact of bacterial plaque on the periodontium at the expense of hypertension. This range was the most representative with 9 hypertensives and 26 controls for a total of 35 (Table II).

Table II : Distribution of the plaque index.

Range of Plaque index	Hypertensives		Controls		p value
	N	%	N	%	
1 – 1.25	5	13,2	7	17,5	<0.001
1.26 – 1.5	9	23,7	26	65,0	<0.001
1.51 – 1.75	20	52,6	6	15,0	<0.001
1.76 – 2.0	4	10,5	1	2,5	<0.001

Hypertensives had a higher mean gingival index and higher mean attachment loss ($p < 0.05$). The mean plaque index and mean bleeding index increased with the severity of hypertension (Table IV).

Table III: Gingival index and loss of attachment as a function of plaque index

Variable	Hypertensives	Controls	p value
Gingival index	1.89 ± 0.2	1.39 ± 0.3	<0.05
Loss of attachment	1.56 ± 0.3	1.26 ± 0.4	<0.05

Logistic analysis using hypertension as the dependent variable showed that, family history (OR: 6.7, [95% CI: 6.5 – 6.9], $p = 0.03$), the plaque index (OR: 1.5, [95% CI: 1.3 – 1.97], $p = 0.042$), the bleeding index (OR: 1.11, [95% CI: 1.1 – 2.3], $p = 0.001$), and attachment loss (OR: 1.5, [95% CI: 1.2 – 3.1], $p = 0.001$) were determinants, and could be associated with hypertension (Table IV).

Table IV: Distribution of periodontal indices according to the severity of hypertension

Variable	Hypertension			p value
	Grade 1	Grade 2	Grade 3	
Plaque index	1.51 ± 0.2	1.58 ± 0.2	1.59 ± 0.2	0.3
Gingival index	1.86 ± 0.2	1.88 ± 0.2	1.93 ± 0.2	0.62
Loss of attachment	1.58 ± 0.3	1.53 ± 0.3	1.58 ± 0.3	0.24

DISCUSSION

We carried out this cross-sectional comparative study to assess the association of periodontal indices and hypertension in a group of patients. The mean plaque index was significantly higher in hypertensives. This is comparable with that reported by Leye et al. [10] in 2014 in Senegal. There is evidence that hypertension is associated with microvascular dysfunction. This will result in a reduction in blood supply to the salivary glands. Constituents of blood are important in the production of saliva. Changes in blood constituent will thus lead to the modification in the flow of saliva. Masood et al. [11] showed that the flow of salivary was lower in those with hypertension than healthy controls. This condition of low salivary flux favours an increase in bacterial activity, thus the formation of plaques. However, this difference was not statistically significant. The first reaction of periodontal tissues to bacterial plaque is inflammation of the gum. The bleeding index is indicative of the inflammatory activity of the

periodontium. This was significantly higher in hypertensives. Our finding was similar to that reported by Iwashima et al. [12] in Japan, and Leye et al. [10] in Senegal. In a nationwide study by Tsakos et al. [13] in the USA, there was a significant association between gum bleeding and hypertension in adults. However, our findings were not similar to that reported by Ollikainen et al. [14] in 2014. The mean attachment loss was greater in hypertensive patients. This was similar to that reported by Ollikainen et al. [14].

We observed that plaque index and bleeding index increased with the severity of hypertension. On the other hand, this distribution was not the same for the loss of attachment where the lowest mean score was seen in those with grade 2 hypertension. Our findings are similar to that reported by Aworjolu et al. in Nigeria in 2016. Hypertension causes modifications in the blood vessels. In the gum, these microvascular modifications render it fragile, thus vulnerable to bacterial infections [15]. Some studies have reported that periodontal pathogens especially *Porphyromonas gingivalis* and *Actinobacillus actinomycetemcomitans* can be found in atheromatous plaques. Concerning *P. gingivalis*, its role has been recognized in the induction of the expression of cell adhesion molecules including ICAM-1, VCAM-1 and p-selectin. Thus, the endothelial cells are activated, and smooth muscle cell proliferation is triggered with resultant alteration of vasomotor function [15]. Knowing the harmful effect of atheroma plaques on the evolution of hypertension, this could explain the increase in blood pressure values concomitant with plaque index and gingival index. The loss of attachment is a chronic process of multifactorial etiology. In addition to the gingival inflammation involved, there is an inter human variability in their response [16]. This could explain this divergence of evolution according to the severity of hypertension. Periodontal disease was assessed using periodontal indices. Oral hygiene was assessed by plaque index, inflammation of the gum was assessed by bleeding index, and the involvement of the deep periodontium was evaluated by the loss of attachment. This study may suggest an association between periodontal disease and hypertension. However, the two groups were significantly different in terms of age, sex and weight, and this may have biased our findings.

CONCLUSION

Periodontal diseases are characterized by the presence of plaques, gingival bleeding, periodontal pocket and / or loss of attachment. Hypertensive patients seem to be more affected by periodontal disease than normotensives, but we cannot draw a definite conclusion of a cause and effect relationship. Further studies are needed to better assess this issue and to see if treating periodontal disease will improve on blood pressure control in our setting.

RESEARCH IN CONTEXT

- What is known about this subject : Periodontal disease and Hypertension are very frequent in our setting suggesting an association.
- What this study adds : There is an association of periodontal disease and essential hypertension. The severity of periodontal disease increases with the severity of hypertension.

DISCLOSURE

Acknowledgement : We thank the participants for accepting to take part in this study.

Conflict of interest : We declare no conflict of interest.

Authors' contribution : All the authors contributed in the conception, design, data collection, data analysis, and drafting of the manuscript. All the authors approved of the final version for publication.

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