



ASSOCIATION BETWEEN PERIODONTAL DISEASE AND BLOOD PRESSURE – A SURVEY

Dr Nisha C. Salvi*

PG Student, CSMSS Dental College, Dept of Periodontology, Aurangabad.
*Corresponding Author

Dr Niraj Chaudhari

Professor, CSMSS Dental College, Dept of Periodontology, Aurangabad.

ABSTRACT

Hypertension is the most prevalent cardiovascular disease increasing the risk of stroke, atherosclerosis, endothelial dysfunction. At risk (Pre hypertension) levels are - Systolic -120- 139, Diastolic – 80-89. High Blood Pressure levels are - Systolic – 140 or above, Diastolic – 90 or above. Periodontitis and hypertension share common risk factors: Smoking, Stress, Socio-economic factors. These Confounds the association between hypertension and periodontal disease. Objective was to assess the risk of hypertension in participants with periodontal disease. A randomized sample of 100 patients within the age group of 18-70 years were selected from the Department of Periodontology. Clinical Parameter recorded were missing teeth, bleeding on probing, gingival recession, probing pocket depth, clinical attachment loss, age, BMI, Smoking status. Blood Pressure assessment- using an automated Sphygmomanometer device. In this study, a significant association between periodontitis and hypertension is seen (45.5%). Association with smoking (41.8%), age and BMI is also found to be prevalent.

KEYWORDS : Hypertension, Periodontitis, endothelial dysfunction.

INTRODUCTION:

Hypertension is one of the most prevalent cardiovascular diseases (CVD) worldwide¹. Hypertension has a complex aetiology, with more evidence suggesting an increased role of inflammation in the development of this condition².

It is a primary modifiable risk factor for cardiovascular, cerebrovascular and renal diseases³ It is estimated that >30% of the overall population suffers from hypertension, and this estimate increases with age. A 15% to 50% of individuals, however, are unaware they are affected by hypertension⁴, whereas many of those with an established diagnosis fail to achieve an optimal BP control despite their prescribed medications⁵.

Hypertension is defined when a patient has an elevated systolic BP greater than 140 mmHg and/or diastolic BP greater than 90 mmHg. A patient with systolic BP ranging between 120 mmHg and 139 mmHg, and/or diastolic BP of 80 mmHg to 89 mmHg, is categorized as prehypertensive. Patients at this stage have the tendency to develop hypertension; hence medical approaches and life style need to be taken care of⁶.

The oral sequelae of periodontal disease, that if untreated ultimately leads to tooth loss, increases morbidity, reduces quality of life and work productivity⁷.

Periodontitis is one potential chronic infectious stimulus for systemic inflammation linked to CVD⁷. Severity of periodontitis correlates with systemic inflammation markers and periodontal therapy reduces systemic inflammation^{8,12}.

Periodontal disease is associated with higher levels of inflammatory markers such as C-reactive protein (CRP), fibrinogen and white blood cells¹³.

Thus, the primary objective of our study was to assess the risk of hypertension in participants with periodontitis, and secondary objectives were to further investigate the level of undiagnosed raised BP in participants with periodontitis.

MATERIALS AND METHODS

A randomized sample of 100 patients within the age group of 18-70 years were selected for the study from the Department of Periodontology. The study was approved by Institutional ethical committee.

Patients who had retained roots, third molars and Implants were excluded from the study.

The Periodontal status of the subjects was assessed by missing teeth, bleeding on probing, gingival recession, probing pocket depth (PPD), clinical attachment loss (CAL).

Periodontal pocket depth was calculated as distance from the free gingival margin to the bottom of the pocket, Recession was calculated as distance from the CEJ to the free gingival margin, and clinical attachment loss (CAL) was calculated as the algebraic sum of recession and PPD measurements.

Additional data collected was age, weight, height, body mass index (BMI), and Smoking status.

BMI was calculated by using the formula kg/m^2 where kg is a person's weight in kilograms and m^2 is their height in metres squared.

Blood Pressure assessment was done using an automated Sphygmomanometer device. [Dr. Odin Digital Blood Pressure Monitor(516 W)]

Statistics:

The data was serialized with all personal information removed and was coded so that only the examiner was able to identify the subject. The statistical analysis was performed using IBMSPSS-20 Statistical Package for the Social Sciences (SPSS) software.

RESULTS:

Among 100 patients, 66 patients had periodontitis, 30 patients were hypertensive, 25 patients were pre hypertensive.

The results in this study showed a significant association between periodontitis and hypertension (45.5%), there was a positive association with smoking (41.8%), also age and body mass index (BMI) was found to be prevalent.

Mainly males had periodontitis (72.7%). Association of periodontitis and blood pressure was seen associated with pre hypertensive patients (31.8%). The regression model analysis showed that age, body mass index (BMI) were associated with hypertension.

Exclusion criteria:

Table 1 Association of Periodontitis with Blood Pressure

| Periodontitis | | BP | | | | Total |
|---------------|-------|-------|-------|--------|------------------|--------|
| | | High | Low | Normal | Pre Hypertensive | |
| No | Count | 0 | 5 | 25 | 4 | 34 |
| | % | 0.0% | 14.7% | 73.5% | 11.8% | 100.0% |
| Yes | Count | 30 | 1 | 14 | 21 | 66 |
| | % | 45.5% | 1.5% | 21.2% | 31.8% | 100.0% |
| Total | Count | 30 | 6 | 39 | 25 | 100 |
| | % | 30.0% | 6.0% | 39.0% | 25.0% | 100.0% |

Table 2

| | Value | df | P value |
|--------------------|---------|----|---------|
| Pearson Chi-Square | 41.230α | 3 | .000 |

As P value is less than 0.05 there is significant association between periodontitis and Blood pressure

Table 3

Association of Age and BMI with Hypertension

| BP | B | Std. Error | Wald | df | Sig. | Exp(B) | 95% Confidence Interval for Exp(B) | | |
|--------|-----------|------------|-------|-------|------|--------|------------------------------------|-------------|-------|
| | | | | | | | Lower Bound | Upper Bound | |
| High | Intercept | -7.158 | 2.832 | 6.388 | 1 | .011 | | | |
| | Age | .064 | .028 | 5.177 | 1 | .023 | 1.066 | 1.009 | 1.127 |
| | BMI | .180 | .099 | 3.292 | 1 | .040 | 1.198 | .986 | 1.456 |
| Low | Intercept | -6.978 | 4.449 | 2.460 | 1 | .117 | | | |
| | Age | .055 | .044 | 1.563 | 1 | .211 | 1.057 | .969 | 1.153 |
| | BMI | .125 | .156 | .636 | 1 | .425 | 1.133 | .834 | 1.539 |
| Normal | Intercept | -2.085 | 2.479 | .708 | 1 | .400 | | | |
| | Age | -.020 | .027 | .565 | 1 | .452 | .980 | .930 | 1.033 |
| | BMI | .143 | .089 | 2.578 | 1 | .108 | 1.154 | .969 | 1.375 |

The regression analysis shows that Hypertension is associated with Age and BMI Association of Hypertension with Smoking

| Association of Hypertension with Smoking | | Blood Pressure | | | | Total |
|--|--------------------|----------------|------|---------|------------------|--------|
| | | High | Low | Normal | Pre Hypertensive | |
| No | Count | 7 | 4 | 25 | 8 | 44 |
| | % | 15.9% | 9.1% | 56.8% | 18.2% | 100.0% |
| Yes | Count | 23 | 2 | 14 | 17 | 56 |
| | % | 41.8% | 3.6% | 25.5% | 30.4% | 100.0% |
| Total | Count | 30 | 6 | 39 | 25 | 100 |
| | % | 30.0% | 6.0% | 39.0% | 25.0% | 100.0% |
| | | Value | df | P Value | | |
| | Pearson Chi-Square | 17.041α | 6 | .009 | | |

DISCUSSION:

The results of this study confirmed an association between high BP and periodontitis, analyzing periodontal clinical parameters. Our study also revealed that 31.8% participants having periodontitis were found to be pre hypertensive.

Several mechanisms underlying the links between gingival diseases and hypertension have been proposed with dysbiotic subgingival microbiome triggering low-grade systemic inflammation and oxidative stress representing the main pathways¹⁴.

Periodontitis patients express not only increased local and systemic inflammatory markers, such as CRP, TNF (tumor necrosis factor)-α, neutrophilic enzymes, WBC, and disparity in T-cell subtypes, but also neutrophil dysfunction, which are all mechanisms resulting in vascular changes and

endothelial dysfunction¹⁵.

Possible Linking Pathways for the Association between Hypertension and Periodontitis are:

1) Inflammation:

High sensitive CRP leads to endothelial dysfunction and periodontal disease induces vascular inflammation. hs-CRP may be a useful marker linking periodontal disease and chronic inflammation, which leads to endothelial dysfunction. Periodontitis has been reported to attenuate endothelium-dependent vasodilatation. This ill-effect was due to the elevation of systemic inflammatory biomarkers (CRP and IL-6), worsening the lipid profile, and increased production of vascular superoxide radicals and reduction of vascular nitric oxide synthase-3 (NOS-3) expression¹⁶.

2. Oral infection:

Periodontitis results from the accumulation of bacterial species in subgingival biofilm, particularly by Gram-negative anaerobic and microaerophilic bacteria¹⁷. These destructs and invades gingival tissue by proteolysis and enters systemic circulation causing transient bacteremia.

3. Oxidative stress:

Periodontitis induces excessive production of ROS in periodontal tissue. As the condition of periodontitis worsens, the production of ROS increases in response to periodontal inflammation; subsequently ROS enter the systemic circulation. With such, oxidation of biomolecules leads to circulating oxidative stress, which may damage various organs. Hence, the increase in circulating oxidative stress elicited by periodontitis may cause detrimental effects on systemic health. Oxidative stress induced by locally infiltrating immune cells also participates in hypertension. Oxidative stress has been implicated in the development of hypertension. ROS are widely accepted as the mediators for vasoconstriction and vascular inflammation, and bioavailability of NO is strongly related to hypertension¹⁸.

4. Endothelial dysfunction:

Periodontal disease may contribute to endothelial dysfunction which eventually increases the risk of hypertension.

According to our study, many patients were unaware of their BP levels, thus BP should also be included in our routine medical history or check up. Besides, it will be even helpful in the periodontal treatment approach as well as it will help to tackle hypertension and its complications

CONCLUSION:

In this study it has been concluded that there is increased risk of periodontitis among hypertensive and pre hypertensive patients. This association has important clinical and public health implications.

This study was conducted to yield better understanding of the mechanism and interactions between hypertension and periodontitis, which will further strengthen the involvement between dental and other medical communities.

REFERENCES:

- Benjamin E.J., Blaha M.J., Chiuve S.E., Cushman M., Das S.R., Deo R., De Ferranti S.D., Floyd J., Fornage M., Gillespie C., et al. 2017 Heart Disease and Stroke Statistics-Update: A Report from the American Heart Association. *Circulation*. 2017;135:e146–e603. doi: 10.1161.
- Drummond G.R., Vinh A., Guzik T.J., Sobey C.G. Immune mechanisms of hypertension. *Nat. Rev. Immunol*. 2019;19:517–532. doi: 10.1038.
- Kearney PM., Whelton M., Reynolds K., Muntner P., Whelton PK., 2005 He J. Global burden of hypertension: Analysis of worldwide data. *Lancet*; 365:217–223. doi: 10.1016
- Mills KT, Bundy JD, Kelly TN, Reed JE, Kearney PM, Reynolds K, Chen J, 2016 He J. Global disparities of hypertension prevalence and control: a systematic analysis of population-based studies from 90 Countries. *Circulation*. ; 134:441–450. doi: 10.1161/CIRCULATIONAHA.115.018912
- Scholes S, Conolly A, Mindell JS. 2020 Income-based inequalities in hypertension and in undiagnosed hypertension: analysis of Health Survey for

- England data. *J Hypertens.* ; 38:912–924. doi: 10.1097
6. A. V. Chobanian, G. L. Bakris, H. R. Black et al., "The seventh report of the joint National Committee on Prevention, detection, evaluation, and treatment of high blood pressure: the JNC 7 report," *Journal of the American Medical Association*, vol. 289,
 7. Tonetti M.S., Jepsen S., Jin L., Otomo-Corgel, 2017 J. Impact of the global burden of periodontal diseases on health, nutrition and wellbeing of mankind: A call for global action. *J. Clin. Periodontol.* ;44:456–462. doi: 10.1111
 8. Slade GD, Offenbacher S, Beck JD, Heiss G, Pankow JS. Acute-phase inflammatory response to periodontal disease in the US population. *J Dent Res* 2000;
 9. D'Áiuto F, Parkar M, Nibali L, Suvan J, Lessem J, Tonetti MS, (2006) Periodontal infections cause changes in traditional and novel cardiovascular risk factors: results from a randomized controlled clinical trial. *Am Heart J* ; 151:977–984.
 10. Higashi Y, Goto C, Jitsuiki D, Umemura T, Nishioka K, Hidaka T, et al. (2008) Periodontal infection is associated with endothelial dysfunction in healthy subjects and hypertensive patients. *Hypertension* ; 51: 446–453.
 11. Tonetti MS, D'Áiuto F, Nibali L, Donald A, Storry C, Parkar M, et al. (2007) Treatment of periodontitis and endothelial function. *N Engl J Med* ; 356:911–920.
 12. Vidal F, Figueredo CM, Cordovil I, Fischer RG. (2009) Periodontal therapy reduces plasma levels of interleukin-6, C-reactive protein, and fibrinogen in patients with severe periodontitis and refractory arterial hypertension. *J Periodontol* ; 80:786–791.
 13. Ioannidou E, Malekzadeh T, Dongari-Bagtzoglou (2006) A. Effect of periodontal treatment on serum C-reactive protein levels: a systematic review and metaanalysis. *J Periodontol*
 14. Del Pinto R, Pietropaoli D, Munoz-Águilera E, D'Áiuto F, Czesnikiewicz-Guzik M, Monaco A, Guzik TJ, Ferri C. Periodontitis and hypertension: is the association causal?
 15. Tonetti MS, D'Áiuto F, Nibali L, Donald A, Storry C, Parkar M, Suvan J, Hingorani AD, Vallance P, Deanfield (2007) J. Treatment of periodontitis and endothelial function. *N Engl J Med.* ; 356:911–920.
 16. C. Brito, S. Dalbó, T. M. Striechen et al., "Experimental periodontitis promotes transient vascular inflammation and endothelial dysfunction," *Archives of Oral Biology*, vol. 58, no. 9.
 17. N. Papapanou, V. Baelum, W.-M. Luan et al., "Subgingival microbiota in adult Chinese: prevalence and relation to periodontal disease progression," *Journal of Periodontology*, vol. 68.
 18. R. M. Touyz, "Reactive oxygen species, vascular oxidative stress, and redox signaling in hypertension: what is the clinical significance?" *Hypertension*, vol. 44.