
Correlation between cardiovascular diseases and periodontitis - a retrospective study

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Abstract: Periodontitis is a chronic inflammatory disease caused by bacterial colonization, which results in destruction of the tissues between the tooth surface and gingiva, loss of connective tissue attachment, erosion of alveolar bone, and tooth loss. There is much evidence stating that prevalent periodontitis is associated with increased coronary heart disease risk. Thus there is a need to evaluate the extent to which the strength of this association has been established. The aim of this study was to evaluate the correlation between cardiovascular diseases and periodontitis. A retrospective study was conducted using the patient records from a private dental college from June 2019 - March 2020. The study population included the case records of cardiovascular disease patients, selected by non-probability purposive sampling. Data was collected and then subjected to statistical analysis. Microsoft Excel 2016 (Microsoft office 10) data spreadsheet was used to collect data and later exported to SPSS IBM (version 20.0). Descriptive statistics and chi square test were employed with a level of significance set at $p < 0.05$. The prevalence of periodontitis among cardiovascular patients was 81.47%. Among patients with CVD, 78.06% of hypertension patients, 3.41% of MI patients and 0.22% patients with other cardiac diseases had periodontitis. Within the limits of this study, there was a significant correlation between CVD and periodontitis ($p = 0.000$), with a higher prevalence among hypertension patients. Patients with periodontitis are at an increased risk for cardiovascular diseases. The systemic inflammatory or immune response to periodontal infection may increase cardiovascular risk. Thus proper oral hygiene practices are important in maintaining overall health.

Keywords: Cardiovascular disease; Hypertension; Myocardial Infarction; Periodontitis

INTRODUCTION

The health of the oral cavity can have wide-reaching effects on overall health. Poor oral health may occur concomitantly with a more serious underlying disease process or may predispose an individual to other health conditions. Protecting oral health is therefore critical in maintaining overall health [Li *et al.*, 2010].

Periodontium refers to the supporting structures around the tooth - namely gingiva, cementum, periodontal ligament and alveolar bone. Periodontitis, one of the most ubiquitous diseases, is characterized by the destruction of connective tissue and dental bone support following an inflammatory host response secondary to infection by periodontal bacteria [Zheng, no date]. Almost all forms of periodontal disease occur as a result of mixed microbial infections within which specific groups of pathogenic bacteria coexist. Various risk factors are associated with periodontal disease which can be either modifiable and non modifiable. These include microorganisms, tobacco smoking, diabetes mellitus, cardiovascular disease, drug-induced disorders, stress, obesity, hematological disorders, host response, pregnancy, female hormonal alterations, and osteoporosis [Ostberg, Halling and Lindblad, 1999].

Cardiovascular diseases (CVD), including acute myocardial infarction and angina pectoris are major health problems in developing countries, and are considered amongst most common medical problems in the general population. [AlJehani, 2014] Smoking, serum cholesterol concentration, hypertension, diabetes and genetics are significant risk factors for the development of cardiovascular disease. [Armitage, 1999] Other risk factors include viral and bacterial infection, which can precipitate a myocardial infarction (MI) in certain susceptible people. Evidence is now emerging that oral health, in particular the periodontal diseases, may also be a significant risk factor for the development of CVD [Salvi *et al.*, 1997].

Periodontitis associated with extensive plaque and calculus deposits are most prevalent and severe in developing countries and in populations with limited access to health education and dental care[(Seymour and Steele, 1998)]. Mild forms of periodontal disease affect 75% of adults, and more severe forms affect 20 to 30% of adults. Since periodontal disease is common in the population, it may account for a significant portion of proposed infection-associated risk for CVD[(Armitage, 2008)].

Cardiovascular disease affects millions of individuals globally with a marked increase in geriatric population. Since this population group is increasing in number and since more elderly individuals are dentate than in the past, there is also an increased incidence of periodontitis in this patient group[(Noack *et al.*, 2001)].

This evidence coupled with recent evidence of linking periodontitis to coronary heart disease suggest the need to evaluate the extent to which the strength of this association has been established[(Baelum, Fejerskov and Karring, 1986),(Genco, Offenbacher and Beck, 2002),(Kinane, 1998)].

Previously our team had conducted numerous clinical trials [(Chaitanya *et al.*, 2017),(Subashri and Uma Maheshwari, 2016),(Steele *et al.*, 2015),(Subha and Arvind, 2019),(Muthukrishnan and Kumar, 2017),(Choudhury, 2015)], in-vitro studies [(Warnakulasuriya and Muthukrishnan, 2018),(Patil *et al.*, 2018),(Rohini and Jayanth Kumar, 2017)] and systematic reviews [(Venugopal and Maheswari, 2016),(Maheswari *et al.*, 2018),(Misra *et al.*, 2015),(Chaitanya *et al.*, 2018),(Dharman and Muthukrishnan, 2016),(Muthukrishnan, Kumar and Ramalingam, 2016)] for the past five years. Now we are focussing on epidemiological studies. The idea for this study stemmed from the current interest in our community. Our team has rich experience in research and we have collaborated with numerous authors over various topics in the past decade (Deogade, Gupta and Ariga, 2018; Ezhilarasan, 2018; Ezhilarasan, Sokal and Najimi, 2018; Jeevanandan and Govindaraju, 2018; J *et al.*, 2018; Menon *et al.*, 2018; Prabakar *et al.*, 2018; Rajeshkumar *et al.*, 2018, 2019; Vishnu Prasad *et al.*, 2018; Wahab *et al.*, 2018; Dua *et al.*, 2019; Duraisamy *et al.*, 2019; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Gheena and Ezhilarasan, 2019; Malli Sureshbabu *et al.*, 2019; Mehta *et al.*, 2019; Panchal, Jeevanandan and Subramanian, 2019; Rajendran *et al.*, 2019; Ramakrishnan, Dhanalakshmi and Subramanian, 2019; Sharma *et al.*, 2019; Varghese, Ramesh and Veeraiyan, 2019; Gomathi *et al.*, 2020; Samuel, Acharya and Rao, 2020)

Thus, the aim of this study was to evaluate the correlation between cardiovascular diseases and periodontitis.

MATERIALS AND METHODS

Study design and setting

This pilot retrospective study examined the records of patients who underwent treatment from June 2019 - April 2020 at a private dental college. Ethical approval was obtained from the Institutional Ethics Committee of the University (SDC/SIHEC/2020/DIASDATA/0619-0320). The study population included case records of patients who had a history of cardiovascular diseases, selected by non-probability purposive sampling. Patients without cardiovascular diseases, patients with other systemic illness, completely edentulous patients and denture wearers were excluded from the study.

Data collection

Case records of 3586 patients who had cardiovascular diseases were reviewed and analysed for the presence of periodontitis. Relevant data such as patient age, sex, type of cardiovascular disease and history of periodontitis were recorded. Repeated patient records and incomplete records were excluded. The final dataset consisted of 2288 patients of Indian origin who had a history of cardiovascular disease. Data was verified by an external reviewer.

Statistical analysis

Data was recorded in Microsoft Excel 2016 (Microsoft office 10) and later exported to the Statistical Package for Social Science (SPSS IBM version 20.0) and subjected to statistical analysis. Descriptive statistics and chi square test were employed with a level of significance set at $p < 0.05$.

RESULTS

The age group of cardiovascular disease patients included in the study were as follows, below 30 years - 8.22%, 30 to 60 years - 61.49%, 60 to 90 years - 30.29% [Figure 1].

About 46.11% were females and 53.89% were males, showing a male predilection towards CVD [Figure 2].

The various cardiovascular diseases prevalent among the patients were hypertension - 95.63%, Myocardial infarction - 4.15% and other cardiac diseases - 0.22% [Figure 3].

The prevalence of periodontitis among cardiovascular patients was 81.47% [Figure 4].

Among patients with CVD, 78.06% of hypertension patients, 3.41% of MI patients and 0.22% patients with other cardiac diseases had periodontitis. Chi square test showed a significant association between cardiovascular diseases and the prevalence of periodontitis ($p < 0.05$) [Figure 5].

About 7.04% of patients with CVD below 30 years, 50.44% of patients between 30 to 60 years and 23.99% of patients between 60 to 90 years had periodontitis. Chi square test showed that there was no significant association between age and the prevalence of periodontitis among CVD patients ($p > 0.05$). The prevalence of periodontitis was higher among CVD patients between 30 to 60 years of age [Figure 6].

Among patients with CVD, about 43.84% of males and 37.63% of female patients had periodontitis. Chi square test showed that there was no significant association between gender and the prevalence of periodontitis among CVD patients ($p > 0.05$). Male patients with CVD had a higher prevalence of periodontitis when compared to females [Figure 7].

DISCUSSION

The data for this retrospective study was based on residents of Chennai seeking treatment at a private dental college in Chennai. Currently there are very few existing studies investigating the association between periodontitis and CVD in the South Indian population.

The results of this study show that the overall prevalence of periodontitis among cardiovascular patients was 81.47% and that there was a significant correlation between CVD and periodontitis. This is in accordance with previous literature. A study by Ketabi et al, showed a strong association between parameters of periodontal disease with cardiovascular disease [Ketabi, Meybodi and Asgari, 2016]. Also a study by Heaton B et al [Heaton *et al.*, 2014] and Hyvärinen K et al [Hyvärinen *et al.*, 2012] have proven periodontal infection as a potential risk factor for cardiovascular disease and, in particular, atherosclerosis.

However, a cross-sectional study from Sweden by Frisk et al, reported no such relation between dental infections and cardiovascular disease [Frisk *et al.*, 2003]. The American Heart Association supports the hypothesis that there is an association between periodontitis and atherosclerotic vascular disease, independent of their confounders [Lockhart *et al.*, 2012].

Few studies have also shown the association between extent and severity of periodontitis with extent and severity of cardiovascular disease (CVD). Kodovazentis et al, in a case-control study showed a consistent association between periodontitis and acute MI. The strength of the association increased concomitantly with the robustness of the criteria used to define periodontitis [Kodovazentis *et al.*, 2014].

In a cross-sectional and analytical study by Marfil-Alvarez et al, it was reported the extent and severity of periodontitis is positively associated with the size of Acute Myocardial Infarction in patients who underwent diagnostic coronary angiography [Marfil-Álvarez *et al.*, 2014].

Holmlund and Lind concluded in their investigation that the number of missing teeth was inversely correlated with the number of carotid arteries with atherosclerotic plaques [Holmlund and Lind, 2012].

The results of this study has to be interpreted with the geographic limitation of the study population and the sample size selected. Hence it cannot be generalized to other populations of geographic and cultural variation. Our institution is passionate about high quality evidence based research and has excelled in various fields (Pc, Marimuthu and Devadoss, 2018; Ramesh *et al.*, 2018; Ezhilarasan, Apoorva and Ashok Vardhan, 2019; Ramadurai *et al.*, 2019; Sridharan *et al.*, 2019; Vijayashree Priyadharsini, 2019; Mathew *et al.*, 2020)

CONCLUSION

Within the limits of this study, there was a significant correlation between CVD and periodontitis ($p = 0.000$), with a higher prevalence among hypertension patients. Therefore, proper treatment and good periodontal maintenance could have a positive effect on the stability, severity, and extent of cardiovascular diseases.

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AUTHORS CONTRIBUTION

Padmaharish V contributed to the study conception and design, data collection, analysis and interpretation and drafted the work. Deepika R contributed to data interpretation, study design and data collection. Deepa G contributed to study conception, design and data collection. All authors critically reviewed the manuscript and approved the final version.

Conflict of interest

The authors declare no conflict of interest.

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GRAPHS

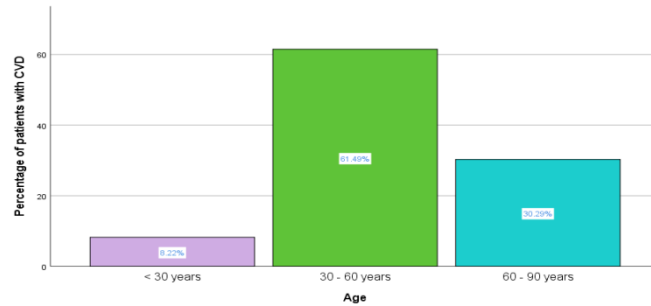


Fig.1: Bar graph representing the age distribution of patients included in this study. X axis represents the age and Y axis represents the percentage of patients of CVD included in this study. The age group of cardiovascular disease patients included in the study were as follows, below 30 years - 8.22%, 30 to 60 years - 61.49%, 60 to 90 years - 30.29%.

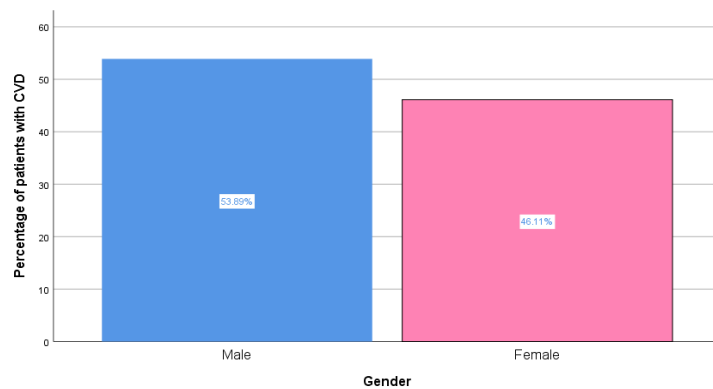


Fig.2 : Bar graph representing the gender distribution among patients. X axis represents the gender and Y axis represents the percentage of patients with CVD included in this study. About 46.11% were females and 53.89% were males, showing a male predilection towards CVD.

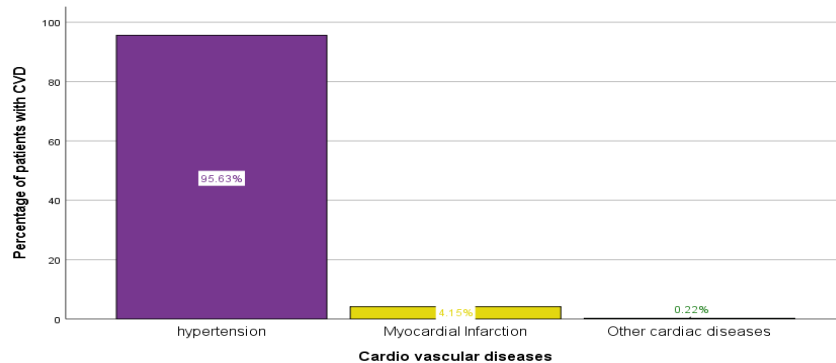


Fig.3: Bar graph representing the prevalence of various cardiovascular diseases. X axis represents the various cardiovascular diseases and Y axis represents the percentage of patients with CVD included in this study. The various cardiovascular diseases prevalent among the patients were hypertension - 95.63%, Myocardial infarction - 4.15% and other cardiac diseases - 0.22%.

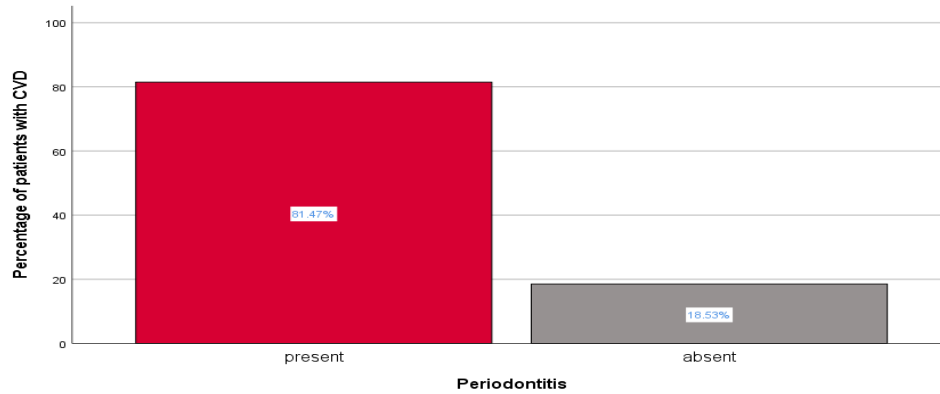


Fig.4 : Bar graph representing the prevalence of periodontitis among CVD patients. X axis represents the prevalence of periodontitis and Y axis represents the percentage of patients with CVD included in this study. The prevalence of periodontitis among cardiovascular patients was 81.47%.

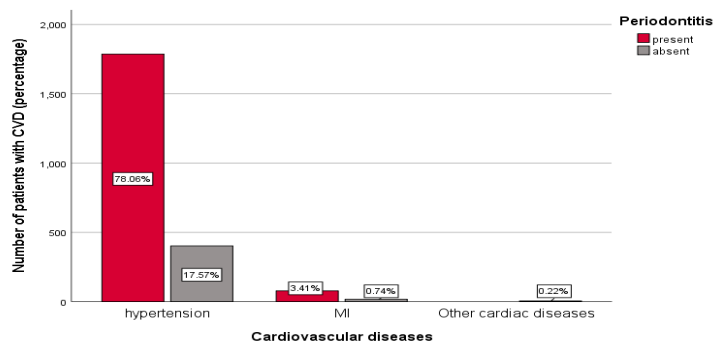


Fig.5: Bar graph representing the association between cardiovascular diseases and periodontitis. X axis represents the various cardiovascular diseases and Y axis represents the number of patients with CVD (percentage). The prevalence of periodontitis was higher in patients with hypertension, followed by patients with MI and patients with other cardiac diseases. There was a significant association between cardiovascular diseases and the prevalence of periodontitis (Chi square test). Pearson Chi square value = 22.043; p-value = 0.000

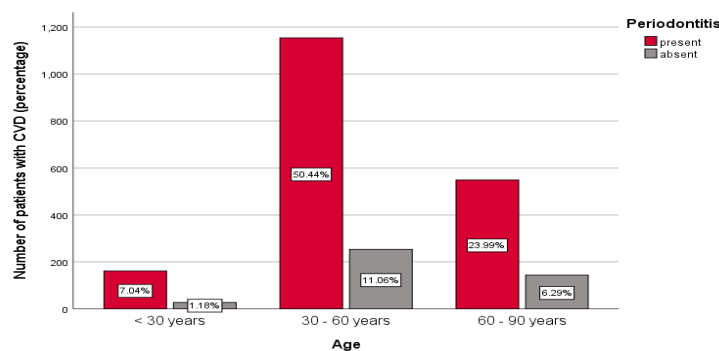


Fig.6: Bar graph representing the association between age and the prevalence of periodontitis among patients with CVD. X axis represents the age and Y axis represents the number of patients with CVD (percentage). The prevalence of periodontitis was higher among CVD patients between 30 to 60 years of age and least among patients below 30 years. However, there was no significant association (Chi square test). Pearson Chi square value = 4.766; p-value = 0.092

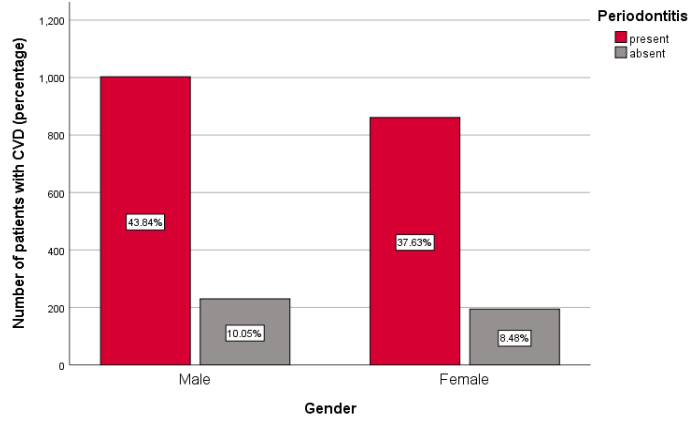


Fig. 6a: Bar graph representing the association between gender and the prevalence of periodontitis among patients with CVD. X axis represents the gender and Y axis represents the number of patients with CVD (percentage). There was no significant association between gender and the prevalence of periodontitis among CVD patients (Chi square test). Pearson Chi square value = 0.026; p-value = 0.871.