

VARIATIONS IN SERUM CONCENTRATIONS OF Hs-CRP IN PERIODONTITIS AND HEALTHY SUBJECTS

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Abstract: CRP is a plasma protein that measures the acute phase response to systemic inflammation and is one of the markers of choice in monitoring numerous chronic diseases. Patients with periodontitis have specific haematological variations, such as higher C-reactive protein (CRP) levels and elevated pro-inflammatory mediator levels. This study aims to quantify Hs-CRP levels in periodontally healthy and diseased subjects and evaluate the relationship between periodontitis and Hs-CRP levels. This Case-control study recruited 120 patients from two study groups—60 cases of chronic periodontitis (moderate to severe) and 60 controls. Periodontitis is assessed by three different index scores, namely: Community periodontal index score (CPI), Clinical attachment level (CAL) and periodontal probing depth (PPD). The Hs-CRP is measured due to its high sensitivity to assess systemic inflammation, making it more effective than conventional CRP tests. Our study results indicate that Hs-CRP levels increase subsequently with the severity of the periodontal disease. Moreover, Clinical attachment level (CAL) is the most significant indicator of Periodontitis that correlates with systemic inflammation in the body. Hence, concluding that periodontitis, being an oral condition, can have a massive impact on general systemic health, and elevated Hs-CRP levels, considered a biomarker of chronic systemic inflammation, can be a future risk to several fatal systemic diseases.

Keywords: CRP; Biomarkers; Inflammation; Periodontitis

Introduction

Periodontitis is an inflammatory disease affecting periodontium integrity, resulting in loss of tooth support caused by uninterrupted microbial plaque, thus stimulating local inflammatory response and systemic inflammatory reaction. It is characterized by bleeding gums, the development of a periodontal pocket that increases probing depth and attachment loss (Könönen et al., 2019). Mounting evidence suggests that untreated periodontitis is increasingly being seen as a potential risk factor in the onset and advancement of several systemic health diseases and their complications (Nazir, 2017). The culprit behind is primarily gram-negative bacteria originating from dental plaque, which disturbs the periodontium fundamental support, leading to the translocation of bacterial products into the bloodstream, resulting in systemic inflammation, which is marked by activated levels of pro-inflammatory mediators, including C-reactive protein (CRP) (Bansal et al., 2014). Elevated CRP levels reflect an attempt of our body to protect against infectious insult, creating an acute inflammatory environment (Chang et al., 2020).

High sensitivity CRP (Hs-CRP) has received much attention as a precise biomarker of systemic inflammation as well as a predictor of future cardiovascular risks such as Myocardial Infarction (MI), stroke, atherosclerotic lesions, and peripheral vascular disease (Polyakova & Mikhaylov, 2020). Furthermore, Hs-CRP is a distinguished mediator between periodontitis and other systemic conditions such as Diabetes, COPD, and Atherosclerosis (Machado et al., 2021; Öztekin et al., 2014).

Recent studies have shown that people with advanced periodontitis had greater CRP levels in their blood than the general population. In addition, the CRP levels gradually decreased after therapy, suggesting that periodontitis was the underlying cause of the escalated blood CRP levels (Hajishengallis & Chavakis, 2021).

This research compared blood Hs-CRP and periodontal parameters in healthy persons and patients with chronic periodontitis to investigate whether an association exists between periodontal factors and systemic inflammatory markers in our local population. Also, we have focused on three different variables for periodontal evaluation to have a clear picture of the influence of periodontitis on high-sensitivity C reactive protein.

Methodology

This study was conducted as a part of a master's project. One hundred twenty patients were divided into 60 cases with moderate to severe chronic periodontitis and 60 controls. They were recruited from the Department of Periodontology at Baqai Dental College between September 2020 and January 2021. The ethics committee of Baqai Medical University has approved the present study with reference number BMUEC/07-2019-04. Before sample collection, each participant signed the consent form. The study sample consisted of two groups of ages 25-45 years, both genders. Subjects with uncontrolled systemic diseases, such as cardiovascular disease, diabetes, arthritis, or acute periodontal abscess, were not included in this research. To

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avoid confounding effects, the study excluded smokers or patients with dental treatment regimens within the last three months.

Periodontal status evaluation:

We used three variables for assessing the periodontal disease status, namely

1. Community periodontal index (CPI),
2. Clinical attachment loss (CAL)
3. Periodontal Probing depth (PPD).

To record the CPI score, a probe is inserted into the sulcus on each sextant's buccal side of the index teeth. The most incredible score attained across all ten index teeth was recorded as the CPI for each individual. WHO recommends that only ten teeth should be examined: 17, 16, 11, 26, 27, 47, 46, 31, 36, and 37, and each tooth is given its suitable CPI score ranging from 0 to 4 (Gomes-Filho et al., 2011).

0= Healthy periodontium

1= Bleeding on probing

2= Calculus detected during probing

3= Periodontal pockets depth 4 to 5 millimetres (shallow)

4= Periodontal pockets depth 6 millimeters (deep)

CAL was measured from the cement-enamel junction (CEJ) to the bottom of the clinical pocket of all permanent teeth, except the third molars, using a UNC periodontal probe at six places per tooth. Then, an average was derived for the whole mouth. CAL is considered the gold standard for periodontal disease assessment and reflects the extent of cumulative disease (Pérez Barrionuevo et al., 2018). Periodontal probing depth was measured using a UNC probe, gently inserted in the gingival sulcus until resistance was encountered in the sulcus base. At last, a mean was calculated for the complete oral cavity.10 Periodontal Probing depth indicates the degree of current disease (Peter et al., 2013).

Estimation of High sensitivity high sensitivity C Reactive protein:

It is done by an immunoturbidimetric method using a Beckman colter AU480 analyzer (Winning et al., 2019).

Results

A sample of 120 subjects, with a mean age of 33 ± 6.98 years, enlisting 60 cases and 60 controls in this study. Among cases, 17.5% are male (n=21) and 32.5% are female (n=39), whereas 18.3% of controls are male (n=22) and 31.7% are female (n=38). The chi-square test indicated a statistically non-significant association for the distribution of gender between cases and controls (P = .849).

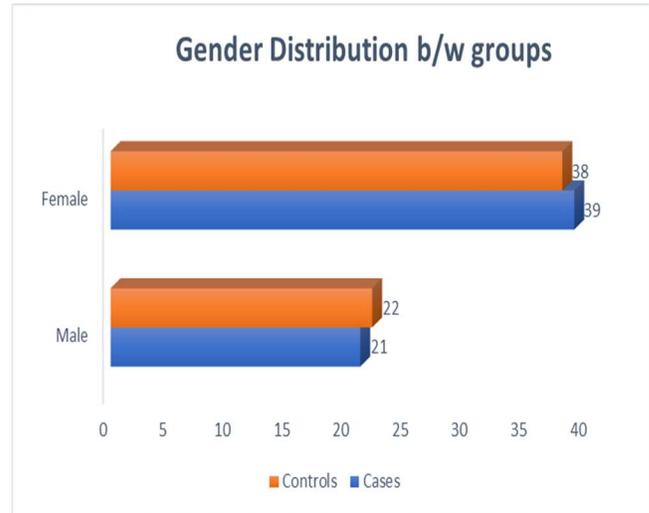


Figure 1: Gender distribution in study population:

Correlation analysis revealed a statistically significant moderate direct relationship for Hs-CRP with Periodontal variables CPI, CAL, and PPD. Of all variables, CAL has the highest correlation with Hs-CRP, indicating CAL has the most significant impact on systemic inflammation (Table 1).

Higher means were obtained for Hs-CRP of cases than controls, whereas lower means were found for periodontal measures of cases than controls. These differences for cases and controls were statistically significant for Hs-CRP, CPI, and CAL & PPD. (Table 2)

Table 1: Spearman correlations between Hs-CRP and Periodontal measures

	CPI	CAL	PPD	Hs-CRP
CPI	-			
CAL	.89**	-		
PPD	.90**	.96**	-	
Hs-CRP	.47**	.52**	.37**	-

Two-tailed test
**P < .01

Table 2: Comparison of Periodontal measures and Hs-CRP among cases and controls

Statistical value	Controls Mean(SD)	Cases Mean(SD)	Mean Difference	P-value
CPI	0.0 (0.0)	2.3 (0.5)	-2.3	.001**
CAL	1.3 (0.4)	4.7 (1.0)	-3.4	.001**
PPD	1.3 (0.4)	3.1 (0.7)	-1.8	.001**
Hs-CRP	2.6 (2.97)	5.5 (5.6)	-3.0	.001**

MD is the Mean difference between cases and controls.
**P < .01

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Discussion

Understanding the potential long-term negative consequences of periodontal inflammation on overall systemic health requires extra attention as this may aggravate other health problems, leading to increased morbidity and mortality. In the present study, Hs-CRP levels correlated with periodontal index severity, confirming a significant but moderate association between periodontitis and higher Hs-CRP levels, a finding which is similar to our study but with assessment done by different parameters and more diverse set of study groups (Chang et al., 2020; Hajishengallis & Chavakis, 2021; Martínez-García & Hernández-Lemus, 2021). The pathophysiology of this association might be the inflammatory changes that occur in the periodontium of the patients, owing to the altered cellular components in their peripheral blood, which are accountable for the elevated levels of local inflammatory mediators. This could result in low-grade systemic inflammation if untreated. Therefore, there is a sharp rise in the production of CRP (Rai et al., 2023). Comparison among the mean Hs-CRP levels in Case (with periodontitis) and Control (without Periodontitis) showed a significant ($p < 0.05$) increase in mean Hs-CRP levels in cases in comparison to controls. A similar association of higher Hs-CRP with cases compared to controls has been previously demonstrated in several studies (Goyal et al., 2014; Machado et al., 2021). On the other hand, a single research found no proof that CRP is persistently higher in periodontitis patients than healthy controls (Reddy et al., 2015). 60% of the cases in our presented Hs-CRP levels of more than four mg/l. Similar to our finding, raised Hs-CRP levels were observed when CAL was greater or equivalent to 4mm with associated bleeding on probing (Martínez-García & Hernández-Lemus, 2021).

Despite several studies suggesting that women had greater CRP levels than males, this study found no such difference between the gender, a conclusion corroborated by a small but significant number of other studies (Boucher JR et al., 1967; Glurich et al., 2002).

This study has some limitations. Participants may have been influenced by Hs-CRP levels owing to mild illnesses, although patients were considered systemically healthy based on self-reporting. Further studies are required, paying close attention to the confounders and modifiers, particularly interventional and longitudinal research with bigger sample sizes are recommended to additionally investigate the association between periodontitis and serum levels of Hs-CRP.

Conclusion

The study concluded that chronic periodontitis outcomes in higher systemic levels of Hs-CRP. As a consequence this may upturn and aggravate the inflammatory activity in chronic pathologies reinforcing periodontitis systemic impact.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.

Approved by the department concerned.

Consent for publication.

Approved

Funding

Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

AMNA AFZAAL (PhD Scholar)

Coordination of collaborative efforts.

Study Design, Review of Literature.

Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, and final approval.

MARYAM AFZAAL (Resident)

Conception of Study, Review of Literature, Final approval of manuscript

DANIA TAHA (M.Phil. Scholar)

Manuscript revisions, critical input.

Coordination of collaborative efforts.

AQSA WAHID GHAURI (General Dentist)

Critical input.

Manuscript drafting.

ZOOMIRRAH SHARIF KHAN (General Dentist)

Coordination of collaborative efforts.

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Drafting articles.

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