Original Research Article

Relationship of chronic periodontitis and plasma C - reactive protein during pregnancy

Navkiran[1], Kaur A[2], Singh S[3], Verma A[4]

[1]Dr Navkiran
MDS, Professor & Head
n.kiran97@yahoo.co.uk
[2]Dr Aneet Kaur
MDS Student
aneetchauhan@yahoo.com
[3]Dr Sartaj Singh
MD, Senior Resident
Guru Nanak Dev Hospital
Amritsar, Punjab, India
[4]Dr Ashish Verma
MDS, Reader
mdsperio78@yahoo.co.in
[1,2,4]Department of Periodontology and Oral Implantology
Sri Guru Ram Das Institute of Dental Sciences and Research
Amritsar, Punjab, India

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Correspondence to:
Dr Navkiran
n.kiran97@yahoo.co.uk

ABSTRACT

Background: *Maternal periodontal disease is a chronic oral infection with local and systemic inflammatory responses and may be associated with adverse pregnancy outcomes. Elevated levels of C-reactive protein has been linked to adverse pregnancy outcomes in maternal periodontal disease.*

Objectives: *To assess plasma C-reactive protein levels in pregnant women with chronic periodontitis and in periodontal health and to compare the incidence of preterm delivery in pregnant women having chronic periodontitis and in periodontal health.*

Materials and Methods: *A total of 122 pregnant women aged 18 years and above with gestational age < 26 weeks were recruited and divided into two equal groups (control group, study group) of 61 each. Blood samples were taken from both the groups to determine the serum C-reactive protein.*

Results: *The mean value of C-reactive protein levels in subjects having chronic periodontitis was higher compared to control group i.e., 2.462±0.318 compared to 1.307±0.361 (P<0.001). The incidence of preterm delivery (< 37 weeks) was 82% in the chronic periodontitis group (study group) compared to 3.3% in the control group (P< 0.001). The incidence of low birth weight(<2500g) was 45.9% in chronic periodontitis (study group) compared to 14.8% in the control group (p< 0.001).*

Conclusion: *The findings from the study suggest that periodontal disease in pregnant women is associated with increased C-reactive protein levels in pregnancy. Incidence of preterm delivery and low birth weight infants is higher in pregnant women with chronic periodontitis compared to healthy controls.*

Keywords: *C-reactive protein, preterm birth, low birth weight*

Introduction

Periodontitis is a local inflammatory process mediating destruction of periodontal tissues triggered by bacterial insult. Circulating C-reactive protein levels are a marker of systemic inflammation and are associated with periodontal disease, which is a chronic bacterial infection associated with elevation of proinflammatory cytokines and prostaglandins. [1,2] C-reactive protein (CRP) is an acute phase reactant produced by hepatocytes in response to diverse inflammatory stimuli and hypoxia. [3] C-reactive protein has been associated with adverse pregnancy outcomes, including preterm delivery, [4] pre-eclampsia, [5] and intrauterine growth restriction. [6] Furthermore, periodontal disease has been associated with increased risk of preterm birth (<37 weeks), [7] low birth weight (<2500g), [8] and preterm low birth weight. [9,10] Therefore, C-reactive protein might be a plausible mediator of the association between periodontitis and adverse pregnancy outcomes. The purpose of this study was to examine the relationship

between periodontitis and plasma C-reactive protein levels among pregnant women and to compare the incidence of preterm low birth weight among pregnant women with and without periodontal disease.

Material and methods

The study included 122 pregnant women attending the Gynaecology and Obstetrics outpatient department (OPD) at SGRD Institute of Medical Sciences and Research, Amritsar. The study participants were divided into two equal groups of 61 each; Group I: Control group, without periodontal disease; Group II: Study group, with chronic periodontitis. An informed consent was taken from all the participants. Screening examination included: 1) medical history; 2) obstetric history; 3) dental history; 4) Periodontal Parameters (Plaque Index, Gingival Index, Probing depth, recession depth and clinical attachment level). The study participants were selected in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1975, as revised in 2000.

Subjects with age group > 18 years, singleton pregnancy with gestational age < 26 weeks having minimum of 20 sound permanent teeth without any systemic disease and having chronic generalized periodontitis with Clinical attachment level (CAL) ≥ 4 mm and willing to sign the consent form were included in the study. Subjects with history of antibiotic intake during pregnancy, multiple pregnancies, intention to deliver at hospital other than that of the study and having other obstetric risk factors like smoking, alcohol consumption, drugs use, etc were excluded from the study.

Periodontal disease activity was determined at the baseline for all the participants using mouth mirror and William's caliberated probe. To diagnose cases of chronic periodontitis following measurements were taken: Plaque Index (Silness and Loe), Gingival Index (Loe and Silness), [11] Pocket probing depth, recession depth and Clinical attachment level. Blood samples were taken for estimation of C-reactive protein levels from the subjects of both groups. C-reactive protein levels were determined using ultrasensitive turbidimetric Immunoassay (ERBA), with a detection limit of 0.0094 mg/dl.

Gestational age was calculated from the last menstrual period (LMP). Birth weight of the newborns was determined within one hour of birth by placing the naked infant on a precise caliberated scale. Birth weight was recorded in grams. Oral hygiene instructions were enforced to all the patients and strict follow up was done until delivery. Infant was categorized according to birth weight [12]: Low weight (< 2500 g), Normal weight (2500-3900 g) and High weight (3900 g). Infant was categorized according to weeks of gestation as [12]: Pre-term (< 37 weeks), Term (37-42 weeks) and Post-term (42 weeks)

The data was collected, compiled and put to statistical analysis using unpaired T-test to compare C- reactive protein levels in group I and group II subjects with normal term and preterm delivery and chi-square test to compare the incidence of preterm and low birth weight in both the groups.

Results

From this study, C-reactive protein levels in pregnant women with chronic periodontitis and in periodontal health was determined using ultrasensitive measurement of C-reactive protein level with a detection limit of 0.0094 mg/dl. There was no significant difference in mean age of mothers in two

groups. The mean value of C reactive protein in Group I (Healthy Controls) was found to be 1.307±0.361 (Mean ± SD) and in Group II (Chronic Periodontitis Group) was 2.462±0.318. There was a statistically highly significant difference in mean C-reactive protein levels in both the groups (P < 0.001). (Table 1) The mean value of C-reactive protein level in group I subjects with term delivery was 1.289±0.354 and in subjects with preterm delivery was 1.800±0.283. A significant difference was found in mean values of C-reactive protein levels in term and preterm delivery in group I subjects**.** The mean value of C-reactive protein level in group II subjects with term delivery was 2.200 ± 0.200 and with preterm delivery it was 2.520 ± 0.311. Here also a significant difference (P=0.002) was found in mean value of C-reactive protein levels in term and preterm delivery in group II subjects. (Table 2) The incidence of Preterm delivery in Group II is 82% where as in Group I it was 3.3%. (Table 3)

Table: 1 Comparison of mean C-reactive protein levels in different groups (descriptives)

CRP	N	Mean	Std. deviation	Difference	't' value
Health	61	1.307	0.361	1.156	18.753**
Periodontitis	61	2.462	0.318		
Total	**122**				

****p<0.001; Highly significant**

Table: 2 CRP levels in group I and group II subjects with normal (term) and preterm delivery

Crp	N	Mean ± SD	Mean difference	95% CI of the difference	t
Group I (Healthy)					
Term	**59**	**1.289 ± 0.354**	**0.511**	**-1.017 to 0.003**	**2.013***
Preterm	**2**	**1.800 ± 0.283**			
Group II (Periodontitis)					
Term	**11**	**2.200 ± 0.200**	**0.320**	**-0.517 to -0.123**	**3.255***
Preterm	**50**	**2.520± 0.311**			

***p<0.05; Significant**

Table: 3 Incidence of preterm and term delivery in group I and group II

Incidence	Pre term		Term		Total		Odds ratio (preterm/ term)	95% CI
	Count	%	Count	%	Count	%		
Group I	**2**	**3.3**	**59**	**96.7**	**61**	**100.0**	**134.091**	**28.375, 633.68**
Group II	**50**	**82**	**11**	**18**	**61**	**100.0**		
Total	**52**	**42.6**	**70**	**57.4**	**122**	**100.0**		

x^2 = 77.222; df = 1; p < 0.001; Highly significant

There was a statistically highly significant difference (P<0.001) in the birth weight between Group I and Group II. The incidence of Preterm Low birth weight was 45.9% in Group II, compared to Group I which was 14.8%. (Table 4)

Table: 4 Incidence of preterm and term birth weight in group I and group II

Incidence	BW >= 2.5		BW< 2.5		Total		Odds ratio(preterm /term)	95% CI
	Count	%	Count	%	Count	%		
Group I	52	85.2	9	14.8	61	100.0	4.902	2.057, 11.684
Group II	33	54.1	28	45.9	61	100.0		
Total	85	69.7	37	30.3	122	100.0		

$x^2 = 14.004$; df = 1; p < 0.001; Highly significant

Discussion

From the results of this study, it was evident that the C-reactive protein levels in pregnant women having chronic periodontitis was higher compared to healthy controls and incidence of preterm delivery and low birth weight was also higher in women having chronic periodontitis compared to control group. The results of the study are consistent with outcomes of investigations which reported an elevation of C-reactive protein levels in periodontitis patients. [13] Various underlying mechanisms for this observation have been identified. Periodontal pathogens not only induce local inflammation and tissue destruction but are also involved in systemic increase in inflammatory and immune response. [14] Low levels of bacteremia, lipopolysaccharides, and other bacterial components may provide a constant stimulus for systemic inflammatory responses such as increased production of C-reactive protein. This is due to the activation of the cascade of inflammatory cytokines produced by monocytes and other cells in periodontal tissues. [15] In various studies, it has been found that high C-reactive protein levels at the beginning of the pregnancy is associated with nearly two-fold increased risk of preterm delivery. [16] In other study, it was found that C-reactive protein levels exceeding the threshold increased the risk of preterm delivery. [4] In the present study also, it was found that the subjects with preterm delivery and preterm low birth weight infants have higher mean C-reactive protein values compared to subjects with normal delivery. This association might be due to the moderate increase in C-reactive protein in chronic periodontitis. [17] Henceforth, the incidence of preterm delivery and pre-term low birth weight was greater in subjects with chronic periodontitis compared to control group. This association was initially suggested by Offenbacher et al, 1996 and was further confirmed in various other studies. [7] In this study, the association observed between C-reactive protein and periodontal disease in pregnancy may or may not be causal. Periodontitis may increase C-reactive protein levels in pregnancy. C-reactive protein could amplify the inflammatory response through complement activation, tissue damage, and induction of inflammatory cytokines in monocytes and therefore, may mediate the association

between periodontitis and adverse pregnancy outcomes.[18] Alternatively, periodontal disease and C-reactive protein may share a common risk factor predisposing certain individuals to a hyperinflammatory response. The IL-1 polymorphism, which is associated with increased risk of periodontitis, is also associated with raised C-reactive protein levels.[13]

The findings from this study suggest that chronic periodontitis in pregnant women is associated with increased levels of C-reactive protein as compared to periodontally healthy controls. This may lead to increased incidence of preterm delivery and eventually preterm low birth weight infants in pregnant women having chronic periodontitis as compared to healthy controls.

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