Original Article

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Dentistry Section

Evaluation of Periodontitis as a Risk for Preterm Birth among Preeclamptic and Non–Preeclamptic Pregnant Women – A Case Control Study

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ABSTRACT

Background: Periodontal disease during pregnancy markedly increases the woman's risk of developing preeclampsia. The aim of the present study was to evaluate and compare whether periodontal disease increases the risk of preterm birth among preeclamptic and non-preeclamptic pregnant women.

Methods: A total of 200 pregnant women (100 preeclamptic and 100 non–preeclamptic) with periodontitis aged 20 to 30 years & < to 26th week of gestation. Maternal demographic and medical data was collected from concerned institutes. In both groups, blood pressure of more than 140/80 mm Hg, presence of protein in 24 hours urine, of more than 1gm per litre in 2 or more mid stream specimens obtained 6 hours apart in the absence urinary tract infection, confirmed by 0.3 g per 24 hours of urine specimens and ankle edema were measured. The periodontal status was categorised as healthy, mild, moderate/severe our worsening. Probing depth (PD), attachment levels and bleeding on probing were measured with UNC–15 probe at six sites per tooth. All the periodontal parameters were measured at second prenatal visit and within 48 hours post–partum.

Results: The present study revealed; the Incidence of preterm birth in relation to periodontal status in preeclamptic patients was significantly high ($p<0.001$). Total incidence of preterm birth in relation to periodontal status in preeclamptic and non-preeclamptic had chi–square value of 17.7, which is highly significant ($p< 0.001$).

Conclusion: The present study demonstrated that pregnant women with preeclampsia are at greater risk for preterm delivery if periodontal disease is present during pregnancy or progress during pregnancy and also rate of preterm delivery is more in preeclamptic women having moderate to severe periodontal disease.

Key words: Periodontal disease, Preeclampsia, Preterm birth

INTRODUCTION

Periodontal diseases are a group of infectious diseases caused predominantly by gram negative anaerobic bacteria, which is common in women of child bearing age [1]. It presents as infection and inflammation of the gingiva and local supporting structures of the teeth, resulting in the destruction of the supporting structures of the teeth. Inflamed periodontal tissues produce significant amount of pro-inflammatory cytokines, mainly interleukin–1 β (IL–1β), interleukin–6 (IL–6), prostaglandin E2 (PG E2), and tumor necrosis factor-alpha (TNF–α) which may have systemic effect on the host [2-7]. Periodontal disease may burden pregnant patients systematically with endotoxin, inflammatory cytokines and oxidative stressors at the maternal fetal interface. This increase in oxidative stress is cytotoxic to maternal vascular endothelium injury, which may be the key feature in the pathogenesis of preeclampsia [8,9]. Preeclampsia is a multisystem disorder specific to pregnancy that occurs spontaneously only in humans and few primates. It usually becomes apparent after 20th week of gestation which is characterised by hypertension (usually higher than 140/90 mmHg), edema and proteinuria [3,8,10,11].

Thus periodontal disease may be a vascular stressor that plays a role in the development of preeclampsia in pregnant patients and in enhancing preterm labor [8,9]. Preterm labor is defined as labor occurring before the 37th completed week [2,12-14]. Pathways present in infections will lead to production of interleukins and tumor necrosis factor by maternal macrophages, which in turn will trigger the increased production of prostaglandins. The marked increase in the prostaglandin level will induce preterm labor [3,8,10,11]. Periodontal disease during pregnancy markedly increases a woman's risk of developing preeclampsia, a significant cause of maternal and perinatal illness affecting 5%–10% of all pregnancies [9]. Each year, an estimated 15 million babies are born preterm (before 37 completed weeks of gestation), and this number is rising [15].

MATERIAL AND METHODS

This case control study was conducted in the Department of Periodontics, PMNM Dental College and Department of Obstetrics and Gynecology; S. Nijalingappa Medical College and hospital, Bagalkot, Karnataka, India. A total of 200 patients were randomly selected within the age group of 20–30 years, prior to their 26th week of gestation with primigravida and divided into 2 Groups. Group I –100 preeclamptic and Group II –100 non–preeclamptic pregnant patients with periodontitis. In both groups oral health examinations were performed on the second prenatal visit (6th month of pregnancy) and within 48 hours post–partum [8,16,17]. Patients with age less than 20 years, who past the 26th week of gestation and had a multiple gestation, also patients with chronic hypertension, pregestational diabetes and heart murmur or heart valve were excluded from the study. As well as any medical condition requiring antibiotic prophylaxis for dental treatment, and patients with human immunodeficiency virus infection were excluded [3,8,18]. Periodontal status was categorised as:

- Healthy – absence of sites with probing depth ≥ 3mm with bleeding on probing,
- Mild – One or more sites with probing depth ≥ 3mm that bleed upon probing but less than 25 sites with probing depth ≥4mm.
- Moderate/severe – 15 or more sites with periodontal probing ≥ 4mm.

- Worsening periodontal status was defined as four or more sites had increased by at least 2mm in pocket depth between the two oral health examinations [3,17].

Clinical parameters determining periodontal status such as bleeding on probing (BOP), Probing depth (PD), clinical attachment levels (CAL) were measured with UNC–15 graduated periodontal probe at six sites per tooth [3,8,18]. Probing depth was measured in millimeters as the distance from gingival margin to the base of pocket. Clinical attachment level was measured in millimeters from cementoenamel junction (CEJ) to the bottom of pocket. Both PD and CAL were measured at the mesiobuccal, buccal, distobuccal, distolingual, lingual, and mesiolingual positions of every tooth. Bleeding on probing was assessed on 6 sites per tooth and deemed positive if it occurred within 15 seconds after probing [8,9,19]. All the parameters were recorded by single examiner.

Preeclampsia – Pregnancy induced hypertension (PIH) occurs after the 20th week of gestation and is characterised by:

- **Hypertension –** High blood pressure, usually higher than 140/90 mm Hg, The rise of blood pressure should be evident at least on two occasions, four or more hours apart.
- **Edema –** Demonstration of pitting oedema over the ankles after 12 hours of bed rest or rapid gain in weight of more than 1 lb per week or more than 5 lb a month in the later month of pregnancy may be the easiest evidence of preeclampsia.
- **Proteinuria –** Presence of protein in 24 hours urine with more than 1gm per litre in 2 or more midstream specimens obtained 6 hours apart in the absence of urinary tract infection is considered significant [8,9,12,20].

A diagnosis of preterm labor should be made in a patient between 20 weeks and 36 weeks, six days of gestation if uterine contractions occur at a frequency of four per 20 minutes or eight per 60 minutes, and are accompanied by one of the following: PROM, cervical dilation greater than 2 cm, effacement exceeding 50 percent, or a change in cervical dilation or effacement detected by serial examinations [21].

An explanation regarding the study was provided to all the participants and an informed consent was obtained. Ethical approval from Institution Review Board was obtained to conduct the study. Statistical analysis was done by using chi–square ($\chi 2$) test and 'z' test. Statistical significance was set at 0.05.

RESULTS

In the present study, the incidence of preterm birth in relation to periodontal status in preeclamptic and non–preeclamptic patients was evaluated. In Group I, 28 patients were periodontally healthy and out of these, ten patients (35.7%) had preterm delivery (preterm cases, defined as those mothers who delivered an infant born alive before 37 weeks gestation). Forty two patients had mild periodontitis, among these 21 patients (50.0%) had preterm delivery. Thirty patients had moderate to severe periodontitis, among these, 25 patients (83.3%) had preterm delivery. As a result, in Group I, overall 56 patients (56.0%) had preterm delivery. In Group II, 38 patients were periodontally healthy and out of these, five patients (13.2%) had preterm delivery. Forty two patients had mild periodontitis, among these seven patients (16.7%) had preterm delivery. Twenty patients had moderate/severe periodontitis, among these; five patients (25.0%) had preterm delivery. In Group II, an overall number of 17 patients (17.0%) had preterm delivery. Incidence of preterm birth in relation to periodontal status in preeclamptic patients were highly significant ($p<0.001$) with a Chi–square value of 14.4 than non–preeclamptic patients where Chi–square value of 1.31 which was non-significant. [Table/Fig-1]. Also the incidence of preterm birth in preeclamptic and non-preeclamptic patients with worsening periodontal status was evaluated. In preeclamptic patients worsening periodontal status with $p<0.001$ was highly significant than non–preeclamptic patients. In Group I patients with worsening periodontal condition 68.1% had preterm delivery and those with stable periodontal status 25% had preterm delivery. Among Group II patients with worsening periodontal status 21.8% had preterm delivery, compare with stable periodontal status (11.1%) [Table/Fig-2].

Periodontal status	Preeclamptic patients (Group I)			Non–preeclamptic patients (Group II)		
	No	Preterm birth	%	No	Preterm birth	%
Healthy	28	10	35.7	38	5	13.2
Mild	42	21	50.0	42	7	16.7
Mod/ severe	30	25	83.3	20	5	25.0
Total	100	56	56.0	100	17	17.0

[Table/Fig-1]: Incidence of preterm birth in relation to periodontal status in preeclamptic and non–preeclamptic patients.
Significance $X^2 = 14.4$, $p< 0.001$, HS $X^2 = 1.31$, $p = 0.52$, NS

Periodontal status	Preeclamptic patients (Group I)			Non–preeclamptic patients (Group II)		
	No	Preterm birth	%	No	Preterm birth	%
Worsening periodontal status	72	49	68.1*	55	12	21.8*
Stable periodontal status	28	7	25.0	45	5	11.1
Total	100	56	56.0	100	17	17.0

[Table/Fig-2]: Incidence of preterm birth in preeclamptic and non–preeclamptic patients with worsening periodontal status within 48 hours of post partum.
$z^*=5.94$ $p<0.001$, HS $z= 1.47$ $p>0.05$, NS

DISCUSSION

Periodontal disease is a chronic destructive inflammatory disease affecting the tooth supporting tissues and is one of the most prevalent chronic infections in humans. The disease is caused by dental plaque, a biofilm in which gram-negative anaerobic microorganisms dominate [22]. Periodontitis could act as a source of bacteria and inflammatory mediators such as interleukins, tumour necrosis factor and prostaglandin E2 (PGE2) that leads to the severity of periodontal breakdown. Daily episodes of bacteraemia or dissemination of bacterial endotoxins originating from the periodontal focus may enter the bloodstream, disseminate throughout the body and trigger the induction of systemic inflammatory responses [23]. These results indicate that progression of maternal periodontal disease during pregnancy increases the risk for preeclampsia, which is considered as a major obstetric complication resulting in preterm delivery. In a case control study conducted in Brazil with a study population of 574 pregnant women with and without preeclampsia having periodontal disease suggested that periodontitis as a risk factor for preeclampsia [24]. Shetty et al., who examined the periodontal condition of 30 preeclamptic women and 100 healthy pregnant controls at recruitment (26–32 weeks of gestation) and within 48 hours after delivery. At enrolment, 100% of the cases and 78% of the controls were diagnosed with periodontal disease. After adjusting for maternal age, body weight, occupation, education and income, severe periodontal disease both at enrolment as well as at delivery was associated with an increased risk of preeclampsia [25]. In a systematic review, it was observed that there was a positive, independent association between maternal periodontitis and preterm birth. These associations were generally attenuated in more robust prospective studies, as well as in studies where periodontitis was assessed as a continuous variable. Also a significant association emerged between maternal

periodontitis and preeclampsia [26]. In another review, the results of observational studies and RCTs investigating the relationship between periodontal disease and preeclampsia. It shows that an association between periodontal disease and preeclampsia was noticed [23]. Also, in the presence of preeclampsia, periodontal disease may be an additional burden that further increases the risk for preterm delivery [8]. The immune system is down regulated in pregnancy, and the pro-inflammatory state observed in pregnancy may be necessary to protect the mother from infection [8,10,27,28]. The mechanism underlying the increased risk for developing preeclampsia and of preterm birth in preeclamptic patients could involve periodontal disease serving primarily as vascular stressor that plays a role in the development of preeclampsia in pregnant patients and in enhancing preterm delivery [9].

The worsening of the periodontal status during pregnancy may reflect an increase in placental infectious/ inflammatory stimuli, which, in turn, may intensify the already elevated inflammatory status of preeclamptic patients, leading to an increased risk of preterm delivery.

The results of the present study showed that there was higher incidence of preterm delivery among the preeclamptic patients with moderate/severe periodontal disease (83.3%) compared to the non preeclamptic patients with moderate/ severe periodontal disease (25.0%) [8]. These results were comparable to the study conducted by Estelle Riche et al., [8]. Similar findings were also observed in research conducted by Jennifer Wider et al., [11]. Our results are in agreement with the study done by Riche et al., [8] according to their results, mothers with preeclampsia may be at greater risk for preterm delivery if periodontal disease is present early in pregnancy or progresses during pregnancy. Incidence of preterm birth was more in preeclamptic patients, whose periodontal status worsened during post–partum. We observed an association between periodontitis and preterm birth in preeclampsia and the association increased with worsening of periodontal status. This data suggests that the infection/ inflammatory burden from periodontal disease may have a strong detrimental effect among preeclamptic patients, leading to preterm delivery [8]. Although studies have suggested that periodontitis act as a risk factor for preeclampsia and also, it has been shown that there is a relation between periodontitis and preterm birth. The present study has shown that the presence of periodontitis in preeclamptic pregnant women increases the risk of preterm delivery compared to non–preeclamptic pregnant women.

CONCLUSION

The etiology of both periodontal disease and preeclampsia is multifactorial. Presence of maternal periodontal disease may represent a surrogate for another maternal factor that predisposes to the development of preeclampsia. The present study demonstrated that pregnant women with preeclampsia having periodontal disease (existing/progressing) are at greater risk for preterm delivery. However, additional studies on larger sample size are required to determine the role of periodontitis as a risk factor for preterm birth in preeclamptic pregnant women.

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