Association between periodontal disease and adverse pregnancy outcomes in a cohort of pregnant women in Jordan

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Summary

Background: The relationship between periodontal disease (PD) and adverse pregnancy outcomes remain unclear. The authors' objective was to assess the risk of adverse pregnancy outcomes in Jordanian women with periodontal disease compared to those without. *Materials and Methods:* Between April 2009 and June 2010, 277 pregnant women with no systemic diseases at gestational age < 20 weeks were enrolled in the study. Dental and oral health examination was performed at enrollment after demographic, medical, and obstetrical information were recorded. Pregnancy outcomes were obtained by phone contact and review of medical records. *Results:* The incidence of periodontal disease in the pregnant women enrolled was 31%. Women with PD were at higher risk for developing preeclampsia (PE), preterm birth (PB), and low birth weight (LBW). The rate of PE in women with PD was 18.6% compared to 7.3% in the control group (p = 0.005) (OR = 2.7, 95% CI: 1.2, 6.0). The OR for PB was (4.4, 95% CI: 1.7, 11.7) and for LBW was (3.5, 95% CI: 1.6, 7.5). *Conclusions:* PD is associated with increased risk of PE, PB, and LBW in healthy Jordanian women.

Key words: Pregnancy outcome; Periodontal disease; Preeclampsia; Preterm birth; Low birth weight.

Introduction

Adverse pregnancy outcomes are variable and can impact maternal physical and mental state because of pregnancy loss, long hospital stay, and the need of medical interference. Also the fetus and then the neonate may be adversely affected with great increase in demand on medical and financial resources. In spite of all the advances in perinatal care, adverse pregnancy outcomes like preterm birth (PB), low birth weight (LBW), and preeclampsia (PE) remain as the main contributors to neonatal and maternal morbidity and mortality. Etiology of spontaneous PB is multifactorial and though many causes have been identified [1], 30%-40% remain with no identifiable cause. Inflammation has been suggested as a major factor in the final common pathway of PB and urogenital infection is considered to be a major pathogenic pathway for PB [2]. Interestingly periodontal disease (PD) was not associated with any of the selected markers of upper genital tract inflammation [3] and treatment of lower genital tract infection during pregnancy has not consistently lowered the rate of PB [4]. It has been suggested that prostaglandin estradiol (E2) levels and nitric oxide levels in the gingival cervical fluid may have some relationship to delivery before term [5, 6]. The association between PD and PB and LBW remains controversial but a growing body of evidence supports this hypothesis [7, 8]. PE is a pregnancy-specific problem with multiple risk factors. Although the etiology of PE is not clear, circulating levels of TNF-α and IL-6 are increased in women with PE compared to pregnant women with no PE [9]. IL-6 and IL-8 were found to be elevated in amniotic fluid in mid-pregnancy of women later developed PE [10]. Strong association between PD and PE was found by many [11, 12] but the mechanism that correlates the two diseases is not clear. The theory that suggests a systemic inflammatory process involving cytokinase TNFα and IL-6 was not confirmed [13]. In this study the authors assessed the risk of adverse pregnancy outcomes in women with PD as compared to those without.

Materials and Methods

The study material included pregnant women randomly selected from multiple prenatal care centers from southern and northern parts of Jordan. This study was approved by the Institutional Review Board of Jordan University of Science and Technology and conducted during the period April 2009 to June 2010. Inclusion criteria were healthy women with singleton pregnancy, confirmed gestational age of 20 weeks or less (by menstrual dating and/or early ultrasonography), and had at least 20 present teeth. Exclusion criteria included women known with hypertension, diabetes mellitus or chronic medical problem, women on anticoagulant or antibiotic prophylaxis, and those with uterine or cervical abnormality.

After medical diseases history was ruled out, consent form was signed and eligible women were interviewed and information obtained regarding age, number of previous pregnancies and their outcome, years of education, employment, and smoking during pregnancy was also recorded. Body mass index (BMI) was recorded and periodontal exam was performed. Pregnancy care was carried out in the prenatal care centers. Women were followed for pregnancy outcome by direct contact and review of medical

records for detailed information regarding, hospital admission, complications of pregnancy, gestational age and birth weight at delivery, and other neonatal outcomes. According to World Health Organization (WHO) criteria, PB is defined as delivery before completion of 37 weeks gestation, LBW is first birth weight below 2,500 grams, and PE is a pregnancy-induced hypertension with protein in the urine of 1+ or more after 20 weeks of pregnancy [14].

Periodontal examination

Periodontal examination was carefully done by a calibrated examiner using sterile examination kit for the mouth, a mirror, and standardized Hu-Friedy periodontal probe with Williams's markings. Examination included number of missing teeth, gingival index (GI), and plaque index (PI) at four sites: mesial, distal, buccal, and lingual. Periodontal state was assessed by probing pocket depth (PPD) over six sites, percentage of bleeding on probing (BOP%) and clinical attachment loss (CAL). Periodontitis was defined as presence of four or more teeth with at least one site or more with PPD ≥ 4 and CAL ≥ 3 mm [15].

Results

Women characteristics

A total of 298 women met the inclusion criteria and agreed to participate in this study. Average age at periodontal examination was 13.8 weeks. Out of these 298 women, 277 completed the study. Their age ranged between 16 and 46 years with a mean (SD) age of 28.0 (6.1) years. More than half of these women (54.9%) had an education level less than high school and 68.2% were not employed. About 54.9% were passive smokers. Of all women, 86 (31.0%) were diagnosed with periodontitis. The socio-demographic, clinical, and obstetric characteristics of women according to periodontal status are shown in Table 1. Women with periodontitis were significantly older than women with no periodontitis and were significantly more likely to report a history of preterm delivery. Women with and without periodontitis differed significantly in order of pregnancy (p = 0.025) and did not differ in other studied medical and obstetric characteristics.

Pregnancy, delivery, and neonatal outcomes

Tables 2 and 3 show the pregnancy, delivery, and neonatal outcomes of women according to the presence of maternal periodontitis. Of the studied pregnancy and delivery outcomes, PE was more likely to occur in women with periodontitis compared to women without periodontitis (18.6% vs 7.3%; p = 0.005). Anemia, hospital admission, vaginal bleeding, postpartum fever, postpartum hemorrhage, and mode of delivery were not significantly different between women with periodontitis and those without periodontitis.

Compared to those without periodontitis, women with periodontitis were significantly more likely to deliver prematurely (19.8% vs 4.7%; *p* < 0.005) and more likely to give a LBW baby (22.1% vs 6.8%; *p* < 0.005). The other studied neonatal outcomes were not significantly different between the two groups of women.

Table 1. — *Socio-demographic, clinical, and obstetrics characteristics of pregnant women according to periodontal status.*

	Periodontitis		*p* value
	No (n =191) n (%)	Yes (n = 86) n (%)	
Age (years)			< 0.005
16 - 24.9	73 (38.2)	15 (17.4)	
25 - 29.9	63 (33.0)	24 (27.9)	
30 - 46	55 (28.8)	47 (54.7)	
Education			0.210
< High school	100 (52.4)	52 (60.5)	
> High school	91 (47.5)	34 (39.5)	
Income (JD)			0.385
< 300	76 (39.8)	39 (45.3)	
> 300	115 (60.2)	47 (54.7)	
Employment			0.455
No	133 (69.6)	56 (65.1)	
Yes	58 (30.4)	30 (34.9)	
Pre-pregnancy BMI			0.467
Normal	106 (55.5)	46 (53.5)	
Overweight	62 (32.2)	25 (29.1)	
Obese	23 (12.0)	15 (17.4)	
Number of living children			0.025
0	73 (38.2)	21 (24.4)	
> 1	118 (61.8)	65 (75.6)	
Cigarette smoking	3 (1.5)	3 (3.5)	0.223
Passive smoking	107 (56.0)	45 (52.3)	0.567
Pregnancy order			0.018
First	54 (28.3)	14 (16.3)	
Second	47 (24.6)	16 (18.6)	
≥ Third	90 (47.1)	56 (65.1)	
Previous PB delivery	14 (7.3)	14 (16.3)	0.022
Previous LBW delivery	32 (16.8)	20 (23.3)	0.200

Table 2. — *Pregnancy and delivery outcomes according to presence of maternal periodontitis.*

Outcome	Periodontitis		*p* value
	No (n =191) n (%)	Yes (n = 86) n (%)	
Anemia	21 (11.0)	14 (16.3)	0.221
Hospital admission	20 (10.6)	9 (10.5)	0.977
Vaginal bleeding	11 (5.8)	3 (3.5)	0.425
PE	14 (7.3)	16 (18.6)	0.005
Postpartum fever	17 (9.0)	6 (7.0)	0.575
Postpartum hemorrhage	13 (6.9)	8 (9.3)	0.483
Cesarean delivery	56 (29.6)	34 (39.5	0.120

Multivariate analysis

Separate models of binary logistic regression were conducted to determine the association between periodontitis and the three main outcome variables (PB, LBW baby, and PE). In the multivariate analysis after adjusting for significant variables in the study group including age, number of live births, pre-pregnancy BMI, previous hypertension, previous preterm birth, anemia, and women who had periodontitis had significantly higher odds to deliver prematurely, deliver babies with LBW, and develop PE during pregnancy. The odds ratios for PD, delivery of LBW baby, and PE associated with periodontitis were (OR = 4.4, 95% CI: 1.7, 11.7), (OR = 3.5, 95% CI: 1.6, 7.5), and (OR = 2.7, 95% CI: 1.2, 6.0), respectively (Table 4).

Table 3. — *Neonatal outcomes according to maternal periodontitis.*

| Outcome | Periodontitis | | *p* value |
	No (n =191) n (%)	Yes (n = 86) n (%)	
PB	9 (4.7)	17 (19.8)	< 0.005
LBW	13 (6.8)	19 (22.1)	< 0.005
Admission to NICU	24 (12.6)	15 (17.4)	0.280
Ventilation > 6 hours	9 (4.7)	10 (11.5)	0.035
Neonatal antibiotic therapy	6 (3.2)	4 (4.7)	0.539
Congenital malformation	4 (2.1)	2 (2.3)	0.903

Table 4. — *Multivariante analysis between periodontitis and adverse pregnancy outcomes.*

Variable	OR (95% confidence interval)	*p* value
PB	4.4 (1.7,11.7)	0.002
LBW	3.5 (1.6,7.5)	0.002
PE	2.7 (1.2,6.0)	0.011

Adjusted for age, number of live births, pre-pregnancy BMI, previous hypertension, previous preterm birth, and anemia.

Discussion

A large portion of PBs are of unknown etiology and so is PE. Efforts are made to try and solve this dilemma in order to reduce maternal and neonatal morbidities and mortalities. PD on the other hand is common and is closely-related to mouth hygiene and dental care. In the last two decades or more, the relation of PD to PB, PE, and other pregnancy outcomes were extensively studied without conclusive evidence. Establishing the relationship between these pregnancy outcomes and PD may help in confirming a cause-effect connection later and help to implement therapeutic and prophylactic measures that may improve some of these outcomes [16, 17]. In the present study group of 277 low-risk women, who were examined at early pregnancy and completed the study, periodontitis was present in 86 (31%) of the women. The demographic and obstetric profiles of both groups, with PD and without PD were similar aside from higher parity in PD group which mostly reflects age effect (Table 1). PE was significantly higher in the group with PD than those without (18.5% and 7.3% respectively, *p* < 0.005) (Table 2), the OR for PE (2.7, 95% CI: 1.2, 6.0). These result were similar to findings by Siqueira *et al.* and Shetty *et al.* but not to others like Khader and Taghzouli [18, 19], who did not find evidence to support this association. Neonatal outcomes showed strong association between PD and PB. Women with PD are at higher risk of PB than those without (19.8% vs 4.7% *p* < 0.005), also PD was significantly associated with LBW (22.1% vs 6.8%, *p* < 0.005) (Table 3) and after multivariant analysis women with PD were at higher risk for both PB (OR = 4.4, 95% CI: 1.7, 11.7) and LBW (OR = 3.5, 95% CI: 1.6, 7.5). Babies born to women with PD required more resuscitation which is related to the higher PB in this group. While similar results were found by other investigators [7, 8], others like Srinjyas *et al.* [20] failed to demonstrate such an association in a compara-

tively large prospective study. Chamberon in his systemic review found consistent association between PD and PB/LBW, but because of the high degree of heterogeneity between studies, he suggested that this finding should be treated with great caution [21]. The remaining controversy in results is probably related to lack of consensus on the criteria for diagnosis of PD, which may influence the frequency of complications, or due to variation in gestational age at time of periodontal assessment which could be partially affected by the hormonal changes of pregnancy on the periodontal tissue [22]. The present authors conclude that PD is associated with significantly increased risk of PE, PB, and LBW in this studied population of Jordanian women. Larger studies are recommended with consensus on criteria for diagnosis of PD and more specified pregnancy outcomes.

Acknowledgment

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