

**Original article**

**Significance of bacterial vaginosis and periodontal infection as Predictors of preterm labor.**

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**Abstract:**

**Aims:** To study the relationship between bacterial vaginosis and periodontal infection in third trimester and preterm labor. **Settings and Design:** The present prospective case control study was conducted in the Department of Obstetrics and Gynaecology from January 2007 to June 2008, Government Medical College and Hospital, Sector 32 Chandigarh in collaboration with Department of Dentistry of the same hospital Institutional Ethics Committee approval was taken, a written informed consent was taken from the patients. **Methods and Material:** Antenatal patients after 28 weeks of period of gestation and with singleton pregnancy attending OPD were included. Besides routine antenatal examination, screening and clinical examination for bacterial vaginosis, dental examination for periodontal infection was done. A total of 500 patients were enrolled for the study. Out of the 500 patients examined, 200 patients were randomly selected and divided into 4 groups with 50 women in each. Group 1 was the control group and the subjects were negative for bacterial vaginosis and periodontal infection. Group 2 was positive for periodontal infection. Group 3 was positive for bacterial vaginosis. Group 4 was positive for both bacterial vaginosis and periodontal infection. All these patients were followed up till their pregnancy outcomes. **Statistical analysis used:** A sample size of 50 patients in each group was calculated to conduct study with a power greater than 80% at a significance level of 5%. Data was analyzed using SPSS version 15.0 for Windows. Bacterial vaginosis and periodontal infection were separately correlated to the preterm birth and perinatal outcome. For ordinal data, groups were compared using Mann Whitney U-test, for continuous data groups were tested for normal distribution using the Kolmogorov-Smirnov test and for categorical data groups were compared using the chi-square test.  $p < 0.05$  was considered statistically significant. **Results:** significant correlation was seen between periodontal infection and preterm labor & preterm premature rupture of membranes. **Conclusions:** significant correlation is seen between periodontal infection and preterm labor & preterm premature rupture of membranes.

**Key-words:** preterm labor; Bacterial vaginosis; periodontal infection; third trimester of pregnancy.

**Key Messages:** Prevention and treatment of periodontal infection in third stage of labour prevents preterm births.

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**Introduction:**

Preterm birth is birth occurring before 37 weeks of gestation. Incidence is 11% of all pregnancies.<sup>2, 3</sup> Intrauterine infection plays a major role.<sup>4</sup> Bacterial

vaginosis (BV) is a most common lower genital tract infection. About 50% of pregnant patients with BV are asymptomatic. BV has been associated with preterm birth.<sup>5, 6, 7</sup> Recently periodontal

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disease has been linked to preterm birth. There are microbiological similarities between oral cavity and female genital tract giving rise to a possible common pathophysiology. <sup>5, 6, 7</sup> The study aims at analyzing the correlation between the bacterial vaginosis and periodontal infection in 3<sup>rd</sup> trimester of pregnancy with preterm labor.

Subjects and Methods:

**Study highlights:**

All patients coming for antenatal check ups in the third trimester after 28 weeks of period of gestation in antenatal clinic whether symptomatic or asymptomatic underwent two sets of examination in addition to the routine antenatal examination, Screening and clinical examination for bacterial vaginosis and dental examination for periodontal infection. The findings of both the examinations were recorded and then follow up for their delivery outcomes in form of period of gestation at which delivery occurs, history of rupture of membranes, mechanism of labor onset whether induced or spontaneous, mode of delivery and postpartum period and the perinatal outcome was done.

**Sample size:**

A total of 500 patients were enrolled for the study. The incidence of Bacterial vaginosis and periodontal infection was calculated for the hospital. Out of these 500 patients, 200 patients were randomly selected and divided into 4 groups.

Group 1(n = 50): Patients with no evidence of bacterial vaginosis and periodontal infection.

Group 2(n = 50): Patients positive for periodontal infection.

Group 3(n = 50): Patients positive for bacterial vaginosis

Group 4(n = 50): Patients positive for periodontal infection and bacterial vaginosis.

Group 1 was the control group with sample size of 50 patients. Groups 2, 3, 4 were compared with the control group and correlated to the preterm birth and perinatal outcomes.

**Study design:**

This was a prospective case control study.

**Inclusion criteria's**

1. Antenatal patients after 28 weeks of period of gestation
2. Singleton pregnancy

**Exclusion criteria's**

1. Twin gestation
  2. Previously diagnosed uterine anomalies
- Any medical disorder like heart disease, chronic renal disease, diabetes, auto immune diseases like

SLE etc

**Procedure:**

Epidemiological data of all the patients were recorded on a preset proforma..

**Examination of the patient:**

**Bacterial vaginosis**

The clinical examination for bacterial vaginosis was carried out in Antenatal clinic by the Gynecologist who recorded the findings on the basis of Amsel's criteria <sup>8</sup>

**1. Character of discharge-** Vaginal discharge if present was characterized by color and character of the discharge.

**2. Vaginal pH-** Swabs were taken from vaginal side walls and tested for pH >4.5 using pH indicator strips.

**3. Detection of clue cells-** A wet mount was prepared and 2 drops of saline applied to the wet mount. Slides were then examined under high power microscopy for clue cells.

**4. Whiff test-** 10% KOH was added to the vaginal secretions and production of fishy odor noticed. A minimum of 2 criteria's out of 4 if present were considered diagnostic for bacterial vaginosis.

**Periodontal examination**

The periodontal examination was carried out in Dental OPD by the Dentist who recorded the periodontal status by using the CPITN Index (Community Periodontal Index of Treatment Needs) with help of a CPITN probe. Ten teeth are recorded in this Index. The ten specified Index teeth were.<sup>9</sup>

17 - Maxillary Right Second Molar.

16 - Maxillary Right First Molar.

11 - Maxillary Right Central Incisor.

26 - Maxillary Left First Molar.

27 - Maxillary Left Second Molar.

37 - Mandibular Left Second Molar.

36 - Mandibular Left First Molar.

31 - Mandibular Left Central Incisor.

46 - Mandibular Right First Molar.

47 - Mandibular Right Second Molar.

CPITN considers the periodontal treatment need with respect to

**I. Score 0** – healthy.

**II. Score 1** – bleeding gingivae on gentle probing.

**III. Score 2** – presence of calculus.

**IV. Score 3** – presence of 4 or 5 mm pockets.

**V. Score 4** – presence of more than or equal to 6 mm pockets.

Patients with a score of 3 or 4 were considered

**Table 1:** Amsel's criterias

			Groups			
			Group 1	Group 2	Group 3	Group 4
Amsel's criterias	Clue cells	+	17	21	39	38
			34%	42%	88%	76%
		-	33	29	11	12
			66%	58%	22%	24%
	Vaginal pH	> 4.5	4	3	20	21
			8%	6%	40%	42%
		< 4.5	46	47	30	29
			92%	94%	60%	58%
	Whiff test	+	3	5	8	16
			6%	10%	16%	32%
		-	47	45	42	34
			94%	90%	84%	64%
	Discharge	B	4	4	41	39
			8%	8%	82%	78%
		M	27	27	6	3
		54%	54%	12%	6%	
N		19	19	3	8	
		38%	38%	6%	16%	

**Table 2:** periodontol infection

		Groups			
		Group 1	Group 2	Group 3	Group 4
CPITN Index	0	25	0	25	0
	% within group	50%	0%	50%	0%
	1	20	0	20	0
	% within group	40%	0%	40%	0%
	2	5	0	5	0
	% within group	10%	0%	10%	0%
	3	0	24	0	25
	% within group	0%	48%	0%	50%
	4	0	26	0	25
	% within group	0%	52%	0%	50%

positive for periodontal infection.

The results were not reported to the clinician who was taking care of women during pregnancy, child birth or puerperium and treatment was offered only to patients who were symptomatic for the disease. This Reseach was getting ethical clearance prior the study

#### **Results:**

Of the total 200 patients, 192 completed the study. Two of group 1, one of group 2, two of group 3 and three of group 4 patients were lost to follow up and were thus excluded from the study.

**Incidence:** Out of total 500 patients examined 192 had bacterial vaginosis. The incidence of bacterial vaginosis was 33.4%. Out of total 500 patients examined 168 had periodontal infection. The

incidence of periodontitis was 33.6%.

#### **Demographic data:**

The mean age of the patients in our study was  $25.88 \pm 3.82$ , the range being 18 to 38 years. The mean BMI of the patients in our study was  $25.73 \pm 1.73$ , the range being 23 to 31 kg/m<sup>2</sup>. The majority of the patients were from urban population (80%) whereas 20% were from rural population. The majority of the patients in our study were primigravidas (50%). The incidence of bacterial vaginosis was 33.4% and of periodontitis was 33.6%.

#### **Bacterial vaginosis: Amsel's criteria's (Table 1)**

**Group 1:** Clue cells were positive in 17 (34%) patients and negative in 33 (66%) patients. Vaginal pH was >4.5 in 4 (8%) patients and <4.5 in 46 (92%). Whiff test was positive in 3 (6%)

patients and negative in 47 (94%) patients. Vaginal discharge was suggestive of bacterial vaginosis in 4 (8%) patients, mixed in 27 (54%) patients and normal in 19 (38%) patients. None of the patients had two parameters positive so they were grouped in bacterial vaginosis negative.

**Group 2:** Clue cells were positive in 21 (42%) patients and negative in 29 (58%) patients. Vaginal pH was >4.5 in 3 (6%) patients and <4.5 in 47 (94%). Whiff test was positive in 5 (10%) patients and negative in 45 (90%) patients. Vaginal discharge was suggestive of bacterial vaginosis in 4 (8%) patients, mixed in 27 (54%) patients and normal in 19 (38%) patients. None of the patients had two parameters positive so they were grouped in bacterial vaginosis negative.

**Group 3:** Clue cells were positive in 39 (78%) patients and negative in 11 (22%) patients. Vaginal pH was >4.5 in 20 (40%) patients and <4.5 in 30 (60%). Whiff test was positive in 8 (16%) patients and negative in 42 (84%) patients. Vaginal discharge was suggestive of bacterial vaginosis in 41 (82%) patients, mixed in 6 (12%) patients and normal in 3 (6%) patients.

42 (84%) patients had 2 parameters positive: Clue cells and vaginal pH >4.5 were seen in 5 (10%) patients, clue cells and positive whiff test were seen in 2 (4%) patients, clue cells and discharge suggestive of bacterial vaginosis seen in 25 (50%) patients, vaginal pH >4.5 and discharge suggestive of bacterial vaginosis seen in 8 (16%) patients and positive whiff test and discharge suggestive of bacterial vaginosis seen in 2 (4%) patients.

8 (16%) patients had 3 parameters positive: Clue cells, vaginal pH >4.5 and positive whiff test were seen in 2 (4%) patients; Clue cells, vaginal pH >4.5 and discharge suggestive of bacterial vaginosis seen in 4 (8%) patients; Clue cells, positive whiff test and discharge suggestive of bacterial vaginosis were seen in 1 (2%) patient and vaginal pH >4.5, positive whiff test and discharge suggestive of bacterial vaginosis were seen in 1 (2%) patient.

These 50 patients were grouped in bacterial vaginosis positive.

**Group 4:** Clue cells were positive in 38 (76%) patients and negative in 12 (24%) patients. Vaginal pH was >4.5 in 21 (42%) patients and <4.5 in 29 (58%). Whiff test was positive in 16 (32%) patients and negative in 34 (68%) patients. Vaginal discharge was suggestive of bacterial vaginosis in 39 (78%) patients, mixed in 3 (6%) patients and

normal in 8 (16%) patients.

38 (86%) patients had 2 parameters positive: Clue cells and vaginal pH >4.5 were seen in 2 (4%) patients, clue cells and positive whiff test were seen in 5 (10%) patients, clue cells and discharge suggestive of bacterial vaginosis seen in 21 (42%) patients, vaginal pH >4.5 and positive whiff test were seen in 1 (2%) patient, vaginal pH >4.5 and discharge suggestive of bacterial vaginosis seen in 5 (10%) patients and positive whiff test and discharge suggestive of bacterial vaginosis seen in 4 (8%) patients.

10 (20%) patients had 3 parameters positive: Clue cells, vaginal pH >4.5 and positive whiff test were seen in 3 (6%) patients; Clue cells, vaginal pH >4.5 and discharge suggestive of bacterial vaginosis seen in 6 (12%) patients and vaginal pH >4.5, positive whiff test and discharge suggestive of bacterial vaginosis were seen in 1 (2%) patient.

2 (4%) patients had all 4 parameters positive. These 50 patients were grouped in bacterial vaginosis positive.

**Treatment:** Group 1 and 2 were negative for bacterial vaginosis. 4 patients in group 1 and 6 patients in group 2 were treated as they were symptomatic for the discharge which was suggestive of bacterial vaginosis. Group 3 and 4 were positive for bacterial vaginosis. 20 patients were treated in group 3 and 4.

#### **Periodontal infection (Table 2)**

**Group 1:** 25 (50%) patients had category 0 periodontal infection, 20 (40%) had category 1 periodontal infection and 5(10%) had category 2 periodontal infection. These patients belonged to periodontitis negative group.

**Group 2:** 24 (48%) patients had category 3 periodontal infection and 26 (52%) had category 4 periodontal infection. These patients belonged to periodontitis positive group.

**Group 3:** 25 (50%) patients had category 0 periodontal infection, 20 (40%) had category 1 periodontal infection and 5 (10%) had category 2 periodontal infection. These patients belonged to periodontitis negative group.

**Group 4:** 25 (50%) patients had category 3 periodontal infection and 25 (50%) had category 4 periodontal infection. These patients belonged to periodontitis positive group.

**Treatment:** 9, 2 and 9 patients were treated for periodontal infection in groups 2, 3 and 4 respectively.

Further analysis about the delivery details,

postpartum complications and details of the baby will be calculated for 48 patients of group 1, 49 patients of group 2, 48 patients of group 3 and 47 patients of group 4 excluding the patients who were lost to follow up.

#### **Delivery details:**

**Gestational age at delivery:** 7 (14.6%) patients had delivery at <37 weeks and 41 (85.4%) had delivery at  $\geq$ 37 weeks in group 1. 16 (32.7%) patients had delivery at <37 weeks and 33 (67.3%) had delivery at  $\geq$ 37 weeks in group 2. The difference was statistically significant ( $p=.036$ ) when compared with group 1. 5 (10.4%) patients had delivery at <37 weeks and 43 (89.6%) had delivery at  $\geq$ 37 weeks in group 3. The difference was statistically insignificant ( $p=.537$ ) when compared with group 1. 15 (31.9%) patients had delivery at <37 weeks and 32 (68.1%) had delivery at  $\geq$ 37 weeks in group 4. The difference was statistically significant ( $p=.045$ ) when compared with group 1

**PROM:** 14 (29.2%) patients in group 1 had PROM, 29 (59.2%) patients in group 2 had PROM, 15 (31.3%) patients in group 3 had PROM and 19 (40.4%) patients in group 4 had PROM. The difference in all the groups was statistically significant ( $p<0.05$ ).

**Mode of delivery:** 9 (18.75%) patients had cesarean and 39 (81.25%) had normal delivery in group 1. 8 (16.32%) patients had cesarean and 41 (83.68%) had normal delivery in group 2. 9 (18.75%) patients had cesarean and 39 (81.25%) had normal delivery in group 3. 13 (27.66%) patients had cesarean and 34 (72.34%) had normal delivery in group 4. The difference in all the groups was statistically insignificant ( $p>0.05$ )

#### **Perinatal characteristics of the patients:**

**Live born (LB) / still born (SB):** None of the neonate was stillborn in the study in any of the four groups.

**Birth weight:** 68 (35.4%) neonates in the study were low birth weight (Birth weight <2.5 kg) and 124 (64.6%) had birth weight  $>2.5$  kg. 9 (18.3%) neonates were low birth weight in group 1 and 23 (46.9%) were low birth weight in group 2. The difference was statistically significant ( $p<0.05$ ). 17 (35.4%) neonates were low birth weight in group 3. The difference was statistically insignificant ( $p>0.05$ ).

19 (40.4%) neonates were low birth weight in group 4. The difference was statistically significant ( $p<0.05$ ).

**Apgar score: (At 1 minute):** 48 (100%) neonates

had apgar score  $>9$  and none had  $<7$  in group 1. 45 (91.8%) neonates had apgar score  $>9$  and 4 (8.2%) had  $<7$  in group 2. 48 (100%) neonates had apgar score  $>9$  and none had  $<7$  in group 3. 46 (97.9%) neonates had apgar score  $>9$  and 1 (2.1%) had  $<7$  in group 4. the presence of low apgars at 1 minute in 4 neonates in group 2 was statistically significant ( $p<0.05$ ).

**(At 5 minute):** 48 (100%) neonates had apgar score  $>9$  and none had  $<7$  in group 1. 48 (98%) neonates had apgar score  $>9$  and 1 (2%) had  $<7$  in group 2. 48 (100%) neonates had apgar score  $>9$  and none had  $<7$  in group 3. 47 (100%) neonates had apgar score  $>9$  and none had  $<7$  in group 4. The difference in all the groups was statistically insignificant ( $p>0.05$ ).

#### **Neonatal morbidity:**

**Respiratory distress syndrome (RDS):** 46 (95.8%) neonates did not have RDS and 2 (4.2%) neonates had RDS in group 1, 45 (91.8%) neonates did not have RDS and 4 (8.2%) neonates had RDS in group 2, 45 (93.8%) neonates did not have RDS and 3 (6.3%) neonates had RDS in group 3 and 44 (93.6%) neonates did not have RDS and 3 (6.4%) neonates had RDS in group 4. The difference in all the groups was statistically insignificant ( $p>0.05$ ).

**Neonatal jaundice (NNJ):** 41 (85.4%) neonates did not have NNJ and 7 (14.6%) neonates had NNJ in group 1, 41 (83.7%) neonates did not have NNJ and 8 (16.3%) neonates had NNJ in group 2, 41 (85.4%) neonates did not have NNJ and 7 (14.6%) neonates had NNJ in group 3 and 41 (87.2%) neonates did not have NNJ and 6 (12.8%) neonates had NNJ in group 4. The difference in all the groups was statistically insignificant ( $p>0.05$ ).

**Hypoglycemia (HG):** 42 (87.5%) neonates did not have HG and 6 (12.5%) neonates had HG in group 1, 43 (87.8%) neonates did not have HG and 6 (12.2%) neonates had HG in group 2, 42 (87.5%) neonates did not have HG and 6 (12.5%) neonates had HG in group 3 and 40 (85.1%) neonates did not have HG and 7 (14.9%) neonates had HG in group 4. The difference in all the groups was statistically insignificant ( $p>0.05$ ).

**Polycythemia (PC):** 47 (97.9%) neonates did not have PC and 1 (2.1%) neonate had PC in group 1, 48 (98%) neonates did not have PC and 1 (12.2%) neonate had PC in group 2, 48 (100%) neonates did not have PC in group 3 and 47 (100%) neonates did not have PC in group 4. The difference in all the groups was statistically insignificant ( $p>0.05$ ).

**Congenital malformations (CMF):** None of the

neonates in groups 1, 2, 3 and 4 had any CMF. The difference in all the groups was statistically insignificant ( $p > 0.05$ ).

**Neonatal death (NND):** None of the neonates in groups 1, 2, 3 and 4 had NND. The difference in all the groups was statistically insignificant ( $p > 0.05$ ). Periodontal infection being individually correlated with preterm labor might have some different mechanism of initiation of the process of preterm labor than other infections like bacterial vaginosis.

#### **Discussion:**

Preterm delivery is one of the leading causes of neonatal morbidity and mortality. Despite improved neonatal care, 70-80% of all perinatal deaths occur among neonates without congenital malformations who are born prematurely. However the causes of preterm labor are poorly understood. Intrauterine infection has been found to play a major role in preterm birth and is thought to be responsible for preterm birth in up to 40% of cases.<sup>4</sup> The aetiology is multifactorial but there is overwhelming evidence to implicate infection. This infective link has focused on association between abnormal genital tract flora in pregnancy as in bacterial vaginosis and preterm birth. Recently infections at other places like periodontal disease have been linked to preterm birth. The mechanism has been an initiation of systemic immune response as a result of infection whether local or distant leading to secretion of pro inflammatory mediators at the chorio-amnion junction which further causes changes progressing to preterm labor. In a study an inter relationship between periodontal infection, bacterial vaginosis and preterm labor and found microbiological similarities between the oral cavity and the female genital tract giving rise to a possible common pathophysiology.<sup>10</sup>

Most of these infections are asymptomatic and unfortunately by the time a woman is admitted in preterm labor there may be irreversible changes that render any attempts to inhibit the process useless. Since these infections are amenable to treatment, it is logical to presume that their identification and treatment early in pregnancy may reduce the risk of preterm birth and its consequences. However it still remains controversial whether screening and treating asymptomatic pregnant women for evidence of infections should be routinely performed and if done at what period of gestation will positive results be apparent.

The present study was designed to assess the

relationship of bacterial vaginosis and periodontal infection both individually and in conjunction to preterm labor and perinatal outcome. This study also identifies the utility of simple screening methods for bacterial vaginosis and periodontal infection that can be applied routinely in out patient department for diagnosis of these infections. It also determines whether subsequent treatment would be useful as a measure to reduce the incidence of preterm labor. There is a paucity of Indian studies to address this issue and hence this becomes a relevant study.

All the groups in the present study were similar with respect to age, BMI and parity status. The mean age of the patients recruited was  $25.88 \pm 3.82$  years, ranging from 18 to 38 years. This study had patients of younger age group as compared to American and European studies. This is likely to be a reflection of early age at marriage and first conception in Indian women. The mean BMI of all the patients was  $25.73 \pm 1.73$  kg/m<sup>2</sup>, ranging from 23 to 31.

Out of 100 patients who were positive for bacterial vaginosis (Group 3 and Group 4) 77% had positive clue cells, 41% had vaginal pH  $> 4.5$ , 24% had positive whiff test and 80% had discharge suggestive of bacterial vaginosis. Out of 100 patients who were negative for bacterial vaginosis (Group 1 and Group 2) 38% had positive clue cells, 7% had vaginal pH  $> 4.5$ , 8% had positive whiff test and 8% had discharge suggestive of bacterial vaginosis. The sensitivity, specificity, positive predictive value and negative predictive value of individual parameters of Amsel's criteria's in this study are as under:

a) Clue cells- sensitivity is 77%, specificity is 62%, positive predictive value is 66.96% and negative predictive value is 73%.

b) Vaginal pH  $> 4.5$ - sensitivity is 41%, specificity is 93%, positive predictive value is 85.41% and negative predictive value is 61.20%.

c) Whiff test- sensitivity is 24%, specificity is 92%, positive predictive value is 75% and negative predictive value is 54.76%.

d) Discharge- sensitivity is 80%, specificity is 92%, positive predictive value is 91% and negative predictive value is 82.14%.

This result signifies that discharge suggestive of bacterial vaginosis is the single parameter having high sensitivity, high specificity, high positive predictive value and high negative predictive value. Currently the clinical criteria's for diagnosing

bacterial vaginosis requires the presence of three out of four Amsel's criteria's. In this study presence of only two criteria's was taken diagnostic as supported by various studies<sup>8, 11</sup>. In study done by Desire Lee, the prevalence of bacterial vaginosis was 38.7%.<sup>8</sup> Vaginal pH was the most sensitive criterion with a sensitivity of 89% & a positive amine odor was most specific criterion with a specificity of 93%. In a study by Dr. Guttman and colleagues the most sensitive indicator was vaginal pH more than 4.5 with a sensitivity of 84% and most specific being the amine odor with a specificity of 97%.<sup>11</sup> In comparison, in this study positive clue cells and vaginal discharge were the more sensitive criterions with a sensitivity of 77% and 80% respectively and positive amine odor and vaginal discharge were more specific criterions with a specificity of 92% each.

In this study the main parameter which was to be correlated with the presence of bacterial vaginosis and periodontal infection was the occurrence of preterm labor. 32.7% of the patients in group 2 (periodontal infection positive) had preterm labor when compared to 14.6% of the control group (group 1), the p value being 0.036. This observation is statistically significant and shows the association between the two. Various studies support this analysis. Guyer et al for the first time pointed toward the association. In a case-control study of 124 pregnant women, they observed that women who delivered at less than 37 weeks' gestation or had an infant that weighed less than 2,500 g had significantly worse periodontal disease than control women.<sup>12</sup> A study by K Jarjoura et al showed higher prevalence of periodontitis in patients with preterm labor ( $p=0.027$ ). In this study 83 were cases and 120 were controls and periodontal examination was done after delivery within 48 hrs.<sup>13</sup>

A Bosanjak et al carried out a study in 81 primiparous Croatian mothers aged 18-39 years. The cases had significantly worse periodontal status than controls ( $p = 0.008$ ). Multivariate logistic regression model, after controlling for other risk factors, demonstrated that periodontal disease is a significant independent risk factor for preterm birth, with an adjusted odds ratio of 8.13 (95% confidence interval 2.73-45.9).<sup>14</sup>

Only 10.4% of the patients in group 3 (bacterial vaginosis positive) had preterm labor when compared to 14.6% of the control group (group 1), the p value being 0.537. This shows that both the groups were similar in this respect and refutes

any association between the two. This is contrary to many studies which show a correlation between bacterial vaginosis and preterm labor.

Nejad et al conducted a study similar to this study that is analyzing 160 patients in third trimester for bacterial vaginosis and found 25% preterm deliveries in study group compared to 11.3% in control group ( $p=0.039$ ).<sup>15</sup> JA Svare et al found only marginal association of preterm delivery with bacterial vaginosis. 31.9% of the patients in group 4 (periodontal infection positive and bacterial vaginosis positive) had preterm labor when compared to 14.6% of the control group (group 1), the p value being 0.045. This observation is also statistically significant. The above result shows that the presence of periodontal infection is associated with preterm labor in a significant number of cases.<sup>16</sup>

In this study there were 9 patients in group 2 who were symptomatic for periodontal infection and were treated for the same but it was observed that all of them still had preterm labor. In group 3, 20 patients were symptomatic for bacterial vaginosis and were adequately treated with Erythromycin and Metronidazole. Only 5 patients in this group had preterm labor and all of them belonged to the treated group. In group 4, 20 patients were symptomatic for bacterial vaginosis and were adequately treated and 9 patients were symptomatic for periodontal infection and were treated for the same. 15 patients in group 4 had preterm labor and out of these 12 were treated for bacterial vaginosis and 5 for periodontal infection. This observation signifies that treatment did not alter the natural course of progression to preterm labor.

This can be explained as the subjects were selected in the third trimester in this study. They were symptomatic for the disease at that time only and were offered treatment then. The infection might have been present since the early gestation and patients had already mounted a systemic immune response which was refractory to treatment later. Thus treating a patient after the infection has established itself does not alter the course. A study by Morency et al on administration of antibiotics in second trimester shows that Metronidazole does not prevent preterm labor but Macrolides do have a role in decreasing the preterm birth.<sup>17</sup>

41 (21.35%) patients in the study had one or the other antenatal complications. The common ones were gestational hypertension, pre eclampsia, intrauterine growth retardation and postdatism.

No group in specific had any association with these complications. Thus periodontal infection and bacterial vaginosis did not contribute to any antenatal complication in this study.

In this study, 77 patients out of 192 (40.1%) had premature rupture of membranes. In the control group 14 (29.2%) had PROM and 34 (70.8%) presented with intact membranes. In group 2, 23 (46.9%) had PROM and 26 (53.1%) presented with intact membranes. The p value between the two groups comes to be 0.003 which is highly significant. This shows that presence of periodontal infection is linked to premature rupture of membranes in patients without any other risk factor for the same. Premature rupture of membranes further adds to preterm deliveries as the number of induced preterm labor increases.

In comparison to group 1, group 3 had PROM in 15 (31.3%) patients and intact membranes in 33 (68.8%) patients, p value being 0.824 which is statistically non significant. SJ Kilpatrick et al<sup>47</sup> carried out a study to specifically look for risk factors for premature rupture of membranes and found no association with bacterial vaginosis as in this study. This is in contrast to study by P Adinkra et al<sup>48</sup> who suggested an association between the two.

In comparison to group 1, group 4 had PROM in 19 (40.4%) patients and intact membranes in 28 (59.6%) patients, p value being 0.249 which is statistically non significant. Comparing group 2 with group 3 also gives a p value of 0.006 which is highly significant. Thus in this study bacterial vaginosis is not associated with the incidence of premature rupture of membranes while periodontal infection is significantly associated with the same.

18 (9.38%) patients had post partum hemorrhage in this study but no group was specifically associated with the same. 12 (6.25%) patients had puerperal sepsis in this study with no predilection for any specific group. Thus periodontal infection and bacterial vaginosis were not associated with any post partum complications in this study.

Total of 68 (35.4%) neonates in the study were low birth weight (Birth weight <2.5 kg) and 124 (64.6%) had birth weight >2.5 kg (p=0.027). Comparing between the groups 9 (18.3%) neonates were low birth weight in group 1 and 23 (46.9%) were low birth weight in group 2 (p=0.003). This result is highly significant if we consider the birth weight only. Group 2 had 32.7% preterm deliveries. If we correlate the birth weight with the

gestational age at delivery 100% of the neonates in group 2 were appropriate for the gestational age. Thus we can conclude that periodontal infection as such might not be responsible for low birth weight of the neonates but being associated with preterm deliveries in significant number of cases adds to the morbidity of low birth weight newborns. Association between LBW and periodontal infection has been seen in other studies too. Offenbacher et al found a significant association (p=0.023).<sup>18</sup> A study by K Jarjoura et al showed significant association with low birth weight. (p=0.04).<sup>13</sup>

17 (35.4%) neonates were low birth weight in group 3 when compared with 18.3% of group 1 (p=0.066). This association is statistically insignificant. Moreover 93.8% neonates in group 3 were appropriate for the gestational age. Thus correlation between bacterial vaginosis and birth weight of neonates could not be elicited as it is not associated with low birth weight in this study. On contrary many studies have found this association. JA Svare et al found a significant association (OR 1.95, 95% CI 1.3-2.9).<sup>16</sup> 19 (40.4%) neonates were low birth weight in group 4 when compared with 18.3% of group 1 (p=0.021). This result is highly significant if we consider the birth weight only. Group 4 had 31.9% preterm deliveries. If we correlate the birth weight with the gestational age at delivery 97.9% of the neonates in group 4 were appropriate for the gestational age. Thus we can conclude that periodontal infection and bacterial vaginosis together being associated with preterm deliveries in significant number of cases adds to the morbidity of low birth weight newborns. Association was found by Marakoglu et al The study results indicated that Periodontitis (OR: 3.6 95% CI: 1.06-12.18) together with bacterial vaginosis (OR: 11.57 95% CI: 1.26-105.7) were independent risk factors of a preterm low birth weight.<sup>19</sup>

Further analysis was done to study any association of periodontal infection and bacterial vaginosis with perinatal outcomes. Majority of the newborns had an apgar of 9 at 1 minute (97.4%). Only 2.6% neonates presented with apgar of 7 at 1 minute. 4 of these neonates belonged to group 2 that is with periodontal infection positive (p=0.035) which is significant for the study. 191 neonates had an apgar of 9 at 5 minutes (99.5%).

12 (6.3%) neonates had respiratory distress at birth which recovered within few minutes. These neonates were equally distributed in all the groups and no significant association could be put forward



( $p=0.882$ ). Out of these 12, 8 had distress due to prematurity itself, 3 had transient tachypnea of newborn and 1 had birth asphyxia.

28 (14.6%) neonates had neonatal jaundice. These neonates were equally distributed in all the groups and no significant association could be put forward ( $p=0.97$ ). None of them had very high level of bilirubin and majority were due to prematurity itself. Thus periodontal infection being linked to preterm labor indirectly is associated with high incidence of neonatal jaundice.

25 (13%) neonates had hypoglycemia. These neonates were equally distributed in all the groups and no significant association could be put forward ( $p=0.978$ ). 21 of them needed intravenous fluids to correct the hypoglycemia but all of them recovered and majority were due to prematurity itself. Thus periodontal infection being linked to preterm labor indirectly is associated with high incidence of hypoglycemia.

Only 2 neonates in this study had polycythemia and it was not associated with any specific group. None of the neonates were congenitally malformed or stillborn. Thus this study refutes any direct association between these infections and perinatal adverse outcomes. But as it is seen that majority of episodes of neonatal jaundice and hypoglycemia are seen in preterm neonates, indirect association is seen with periodontal infection.

Similar observations were made in various studies. H Leitich et al carried out a study which showed association of bacterial vaginosis with preterm labor but not with any adverse perinatal outcomes.<sup>20</sup>

In conclusion, significant correlation is seen between periodontal infection and preterm labor & preterm premature rupture of membranes. Bacterial vaginosis is not found to be associated with preterm labor. Both of them have no significant correlation with perinatal outcomes.

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### References:

- Cunningham FG, Leveno KJ, Bloom SL, Hauth JC, Gilstrap LC, Wanstrom KD. In Williams's Obstetrics. 22nd ed. New York: Mcgraw Hil, Medical Publishing Division 2005. p. 856.
- McCormick MC. The contribution of low birth weight to infant mortality and childhood morbidity. *N Engl J Med* 1985;312:82-90.
- Goldenberg RL, Rouse JD. Prevention of premature birth. *N Engl J Med* 1998; 339:313-20.
- Romero R, Mazor M. Infection and preterm labor. *Clin obstet gynecol* 1988; 31:553-84.
- Majeroni BA. Bacterial Vaginosis: An Update. *American family physician* 1998; 57:6.
- Meis PJ, Goldenberg RL, Mercer B, Moawad A, Das A, McNellis D et al. The preterm prediction study: significance of vaginal infections. National Institute of Child Health and Human Development Maternal-Fetal Medicine Units Network. *Am J Obstet Gynecol* 1995; 173:1231-5.
- Hay PE, Lamont RF, Taylor-Robinson D, Morgan DJ, Ison C, Pearson J. Abnormal bacterial colonization of the genital tract and subsequent preterm delivery and late miscarriage. *BMJ* 1994; 308:295-8.
- Guttman RE. Any two of Amsel's criteria may indicate bacterial vaginosis. *OB/GYN News* 2001.
- Peter S. Essential of preventive and community dentistry. 2nd ed. New Delhi. Arya(medi) publishing house; 2005. p. 173-4.
- Pretorius C, Jagatt A, Lamont RF. The relationship between periodontal disease, bacterial vaginosis, and preterm birth. *J Perinat Med.* 2007; 35(2):93-9.
- Lee D. Two criteria may be sufficient to diagnose bacterial vaginosis. *Obstet Gynecol* 2005; 105:551-56.
- Guyer B, Strobino DM, Ventura SJ. Annual summary of vital statistics-1994. *Pediatrics* 1995; 96:1029-39.
- Jarjoura K, Devine PC, Delboy AP, Abreu NH, D'Alton M, Papapanou PN. Markers of periodontal infection and preterm birth. *Am J Obstet Gynecol* 2005; 192:513-9.
- Bosnjak A, Relja T, Vucicevic-Boras V, Plasaj H, Plancak D. Pre-term delivery and periodontal disease: a case-control study from Croatia. *J Clin Periodontol* 2006 ;337;10-6.
- Nejad VM, Shafaie S. The association of bacterial vaginosis and preterm labor. *J Pak Med Assoc.*2008 ;58(3):104-6.
- Svare JA, Schmidt H, Hansel BB, Lose G. Bacterial vaginosis in a cohort of Danish pregnant women; prevalence and relationship with preterm delivery, low birth weight and perinatal infections. *Brit J Obstet Gynecol* 2006; 113; 1419-25.
- Morency AM, Bujold E. The effect of second-trimester antibiotic therapy on the rate of preterm birth. *J Obstet Gynaecol Can* 2007; 29(1):35-44.
- Offenbacher S, Jared, O'Reilly. Potential pathogenic mechanisms of periodontitis associated pregnancy complications. *Ann Periodontol* 1998 3:233-50.
- Marakoglu I, Gursoy UK, Marakoglu K, Cakmak H, Ataoglu T. Periodontitis as a risk factor for preterm low birth weight. *Yonsei Med J.* 2008 Apr 30; 49:200-3.
- Leitich H, Kiss H. Asymptomatic bacterial vaginosis and intermediate flora as risk factors for adverse pregnancy outcome. *Clin Obstet Gynaecol* 2007 Jun; 21:375-90.