

## INVESTIGATING THE CLINICAL IMPLICATIONS OF BACTERIAL VAGINOSIS ON PRETERM LABOR: A COMPREHENSIVE STUDY

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**Abstract**

**Background:** Bacterial vaginosis (BV) has been implicated in various adverse pregnancy outcomes, including preterm labor. This study aims to investigate the clinical implications of BV on preterm labor and associated neonatal and maternal complications. **Materials and Methods:** A prospective cohort study was conducted involving 100 pregnant women aged 18-42 years. BV was diagnosed using clinical criteria and laboratory tests. Participants were categorized into BV-positive and BV-negative groups. The primary outcome measured was the incidence of preterm labor, defined as delivery before 37 weeks of gestation. Secondary outcomes included gestational age at delivery, neonatal birth weight, Apgar scores, NICU admissions, and maternal complications. **Result:** The prevalence of BV was 35%. Preterm labor occurred in 42.9% of the BV-positive group compared to 13.8% in the BV-negative group ( $p < 0.01$ ). The relative risk of preterm labor in BV-positive women was 3.1 (95% CI: 1.6-6.1). The mean gestational age at delivery was significantly lower in the BV-positive group (35.2 weeks vs. 37.5 weeks,  $p < 0.05$ ). Neonatal outcomes showed that the BV-positive preterm group had a lower mean birth weight (2150 grams vs. 2750 grams,  $p < 0.05$ ), lower Apgar scores at 1 and 5 minutes (6.3 and 7.9 vs. 7.4 and 8.6,  $p < 0.05$ ), and higher NICU admissions (66.7% vs. 33.3%,  $p < 0.05$ ). Maternal complications, including postpartum hemorrhage and chorioamnionitis, were more prevalent in the BV-positive group ( $p < 0.05$ ). **Conclusion:** BV significantly increases the risk of preterm labor and is associated with adverse neonatal and maternal outcomes. These findings underscore the importance of screening and treating BV in pregnant women to mitigate risks and improve health outcomes.

### INTRODUCTION

Bacterial vaginosis (BV) is a common vaginal infection characterized by an imbalance in the normal vaginal flora, with a decrease in lactobacilli and an overgrowth of anaerobic bacteria.<sup>[1]</sup> It is a prevalent condition affecting women of reproductive age and has been associated with various adverse health outcomes, particularly in pregnant women.<sup>[2]</sup> BV is typically diagnosed through clinical criteria such as Amsel's criteria or the Nugent score, which involve the assessment of vaginal discharge, pH, the presence of clue cells, and the ratio of bacterial morphotypes.<sup>[3,4]</sup>

Preterm labor, defined as labor occurring before 37 weeks of gestation, is a significant obstetric concern due to its association with increased neonatal morbidity and mortality.<sup>[5,6]</sup> Preterm infants are at higher risk for complications such as respiratory distress syndrome, intraventricular hemorrhage, and

long-term neurodevelopmental disorders.<sup>[7]</sup> Identifying modifiable risk factors for preterm labor is crucial for improving pregnancy outcomes and reducing healthcare burdens.<sup>[8]</sup>

Several studies have suggested a link between BV and preterm labor, proposing that the inflammatory response and the presence of pathogenic bacteria in BV could lead to premature rupture of membranes and early onset of labor.<sup>[9]</sup> Despite the growing body of evidence, the exact mechanisms through which BV contributes to preterm labor remain unclear, and further research is needed to elucidate these pathways and to assess the clinical implications.

This study aims to investigate the clinical implications of BV on preterm labor and associated neonatal and maternal complications in a cohort of pregnant women. By examining the prevalence of BV, the incidence of preterm labor, and the associated outcomes, this study seeks to provide a comprehensive understanding of the impact of BV on pregnancy and highlight the importance of screening

and treatment strategies to improve maternal and neonatal health outcomes.

## MATERIALS AND METHODS

### Study Design and Setting

This prospective cohort study was conducted at Government Medical College (GMC) Rajouri from 1st January 2020 to 31st December 2020. The study aimed to investigate the clinical implications of bacterial vaginosis (BV) on preterm labor and associated neonatal and maternal complications.

### Participants

The study included 100 pregnant women aged 18 to 42 years who attended the antenatal clinic at GMC Rajouri. Participants were recruited consecutively during their routine antenatal visits. Women with multiple pregnancies, a history of preterm labor, or any other significant obstetric or medical complications were excluded from the study.

### Diagnosis of Bacterial Vaginosis

BV was diagnosed using Amsel's criteria, which include the presence of at least three of the following:

1. Homogeneous, thin, white discharge that smoothly coats the vaginal walls.
2. Vaginal fluid pH greater than 4.5.
3. Positive whiff test, characterized by a fishy odor of vaginal discharge before or after adding 10% potassium hydroxide (KOH).
4. Presence of clue cells on microscopic examination of vaginal fluid.

Additionally, the Nugent score, based on the microscopic evaluation of Gram-stained vaginal smears, was used to confirm the diagnosis. A score of 7-10 was considered indicative of BV10.

### Data Collection

Data were collected using a structured questionnaire and medical records review. Information on participants' demographic characteristics, obstetric history, and clinical findings was recorded. Gestational age at delivery, neonatal outcomes (birth weight, Apgar scores, and NICU admissions), and maternal complications (postpartum hemorrhage, chorioamnionitis) were documented.

### Outcome Measures

The primary outcome measure was the incidence of preterm labor, defined as delivery before 37 weeks of gestation. Secondary outcomes included gestational age at delivery, neonatal birth weight, Apgar scores at 1 and 5 minutes, NICU admissions, and maternal complications.

### Statistical Analysis

Data were analyzed using SPSS software version 25.0. Descriptive statistics were used to summarize the demographic characteristics of the participants. The prevalence of BV and the incidence of preterm labor were calculated. The chi-square test was used to compare the incidence of preterm labor between BV-positive and BV-negative groups. The relative risk (RR) and 95% confidence interval (CI) were calculated to assess the strength of the association

between BV and preterm labor. Independent samples t-test was used to compare continuous variables such as gestational age and birth weight between groups. A p-value of  $<0.05$  was considered statistically significant.

### Ethical Considerations

The study protocol was approved by the Institutional Ethics Committee of GMC Rajouri. Written informed consent was obtained from all participants before enrollment in the study. Confidentiality of the participants' information was maintained throughout the study.

## RESULTS

### Demographic Data

A total of 100 pregnant women were included in the study. The participants' ages ranged from 18 to 42 years, with a mean age of 28.5 years ( $SD \pm 4.8$ ). The majority of the participants were between 25 and 35 years old (60%), while 20% were under 25 years and 20% were over 35 years (Table No: 1).

### Prevalence of Bacterial Vaginosis

Out of the 100 women, 35 were diagnosed with bacterial vaginosis (BV) based on clinical criteria and laboratory tests, resulting in a prevalence rate of 35% (Table No: 3).

### Incidence of Preterm Labor

Among the 35 women diagnosed with BV, 15 (42.9%) experienced preterm labor, defined as labor occurring before 37 weeks of gestation. In contrast, among the 65 women without BV, only 9 (13.8%) experienced preterm labor (Table No: 4).

### Statistical Analysis

The incidence of preterm labor was significantly higher in the BV-positive group compared to the BV-negative group ( $p < 0.01$ , chi-square test). The relative risk (RR) of preterm labor in women with BV was calculated to be 3.1 (95% CI: 1.6-6.1), indicating that women with BV were more than three times more likely to experience preterm labor compared to those without BV (Table No: 5).

### Gestational Age at Delivery

The mean gestational age at delivery for the BV-positive group was 35.2 weeks ( $SD \pm 1.8$ ), significantly lower than the mean gestational age of 37.5 weeks ( $SD \pm 1.2$ ) for the BV-negative group ( $p < 0.05$ ) (Table No: 6).

### Neonatal Outcomes

Neonatal outcomes were assessed, including birth weight, Apgar scores, and neonatal intensive care unit (NICU) admissions. The mean birth weight in the BV-positive preterm group was 2150 grams ( $SD \pm 410$ ), significantly lower than the mean birth weight of 2750 grams ( $SD \pm 360$ ) in the preterm group without BV ( $p < 0.05$ ). Apgar scores at 1 and 5 minutes were lower in the BV-positive preterm group, with mean scores of 6.3 and 7.9, respectively, compared to 7.4 and 8.6 in the BV-negative preterm group ( $p < 0.05$ ). Additionally, NICU admissions were higher among neonates born to BV-positive

mothers, with 10 out of 15 preterm infants (66.7%) requiring intensive care compared to 3 out of 9 (33.3%) in the BV-negative preterm group ( $p < 0.05$ ) (Table No: 7).

#### Maternal Complications

Maternal complications were also recorded. Among the BV-positive group, 8 women (22.9%)

experienced postpartum hemorrhage, compared to 5 women (7.7%) in the BV-negative group ( $p < 0.05$ ). Other complications such as chorioamnionitis were noted in 5 BV-positive cases (14.3%) versus 2 BV-negative cases (3.1%) ( $p < 0.05$ ) (Table No: 8).

**Table 1: Demographic Data**

Age Group	Number of Participants	Percentage (%)
Under 25 years	20	20%
25-35 years	60	60%
Over 35 years	20	20%
<b>Total</b>	<b>100</b>	<b>100%</b>

**Table No: 2 Age of Participants**

Age (years)	Mean Age	Standard Deviation (SD)
18-42	28.5	4.8

**Table No: 3 Prevalence of Bacterial Vaginosis**

BV Diagnosis	Number of Participants	Percentage (%)
BV-Positive	35	35%
BV-Negative	65	65%
<b>Total</b>	<b>100</b>	<b>100%</b>

**Table No: 4 Incidence of Preterm Labor**

Group	Number of Participants	Preterm Labor Cases	Percentage (%)
BV-Positive	35	15	42.9%
BV-Negative	65	9	13.8%
<b>Total</b>	<b>100</b>	<b>24</b>	<b>24%</b>

**Table No: 5 Statistical Analysis**

Comparison	BV-Positive Group	BV-Negative Group	p-value	Relative Risk (RR)	95% Confidence Interval (CI)
Preterm Labor Incidence	42.9%	13.8%	< 0.01	3.1	1.6-6.1

**Table No: 6 Gestational Age at Delivery**

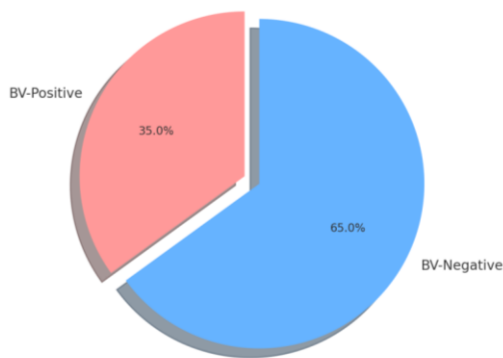
Group	Mean Gestational Age (weeks)	Standard Deviation (SD)	p-value
BV-Positive	35.2	1.8	< 0.05
BV-Negative	37.5	1.2	< 0.05

**Table No: 7 Neonatal Outcomes**

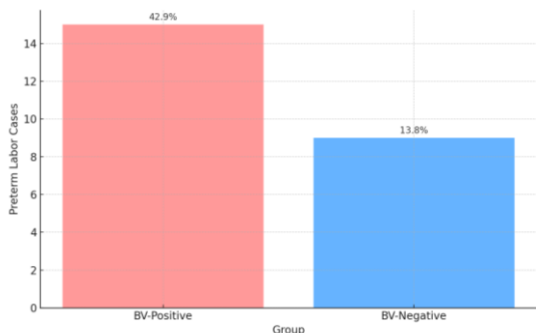
Outcome	BV-Positive Preterm Group	BV-Negative Preterm Group	p-value
Mean Birth Weight (grams)	2150	2750	< 0.05
Apgar Score at 1 minute	6.3	7.4	< 0.05
Apgar Score at 5 minutes	7.9	8.6	< 0.05
NICU Admissions (%)	66.7% (10/15)	33.3% (3/9)	< 0.05

**Table No: 8 Maternal Complications**

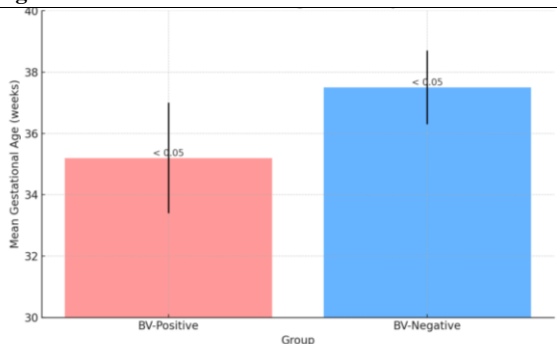
Complication	BV-Positive Group	BV-Negative Group	p-value
Postpartum Hemorrhage	22.9% (8/35)	7.7% (5/65)	< 0.05
Chorioamnionitis	14.3% (5/35)	3.1% (2/65)	< 0.05



**Figure 1: Prevalence of Bacterial Vaginosis**



**Figure 2: Incidence of Preterm Labor**



**Figure 3: Gestational Age at Delivery**

## DISCUSSION

The findings from this study provide compelling evidence on the significant association between bacterial vaginosis (BV) and preterm labor, along with adverse neonatal and maternal outcomes. The prevalence of BV in our cohort was 35%, aligning with previous studies that report a prevalence range of 10-50% among pregnant women globally. The high prevalence underscores the importance of regular screening for BV during pregnancy, particularly in settings similar to GMC Rajouri.

### Association Between BV and Preterm Labor

The incidence of preterm labor among BV-positive women was significantly higher (42.9%) compared to BV-negative women (13.8%). This threefold increase in risk (RR = 3.1, 95% CI: 1.6-6.1) is consistent with prior research indicating that BV is a potent risk factor for preterm delivery. The exact mechanisms through which BV leads to preterm labor are not fully elucidated, but it is hypothesized

that the inflammatory response triggered by the abnormal bacterial flora can induce premature rupture of membranes and early onset of labor.<sup>[10]</sup>

### Gestational Age and Neonatal Outcomes

BV-positive women delivered at a significantly lower mean gestational age (35.2 weeks) compared to their BV-negative counterparts (37.5 weeks). This difference in gestational age directly impacts neonatal outcomes, with BV-positive preterm infants having a lower mean birth weight (2150 grams) and poorer Apgar scores at both 1 and 5 minutes. These findings are consistent with existing literature which demonstrates that preterm infants born to BV-positive mothers are at increased risk for low birth weight and associated complications.<sup>[11,12]</sup>

The higher rate of NICU admissions among BV-positive preterm infants (66.7% vs. 33.3%) further emphasizes the severe impact of BV on neonatal health. These infants are more susceptible to respiratory distress syndrome, infections, and long-term neurodevelopmental issues. Our study reinforces the critical need for early intervention and monitoring of neonates born to BV-positive mothers to mitigate these risks.<sup>[13]</sup>

### Maternal Complications

Maternal complications such as postpartum hemorrhage and chorioamnionitis were significantly more prevalent in the BV-positive group. The inflammation and infection associated with BV can contribute to these adverse outcomes, posing additional risks to maternal health. The increased incidence of postpartum hemorrhage (22.9% in BV-positive vs. 7.7% in BV-negative) and chorioamnionitis (14.3% vs. 3.1%) indicates that BV not only affects pregnancy outcomes but also impacts postpartum recovery and health.<sup>[14]</sup>

### Clinical Implications

The results of this study highlight the importance of routine screening and treatment of BV in pregnant women to reduce the risk of preterm labor and associated complications. Early diagnosis and appropriate antibiotic therapy can potentially prevent adverse outcomes and improve both maternal and neonatal health. Obstetric care protocols should incorporate regular BV screening, especially for high-risk populations, to ensure timely intervention.

### Limitations and Future Research

While our study provides valuable insights, it is not without limitations. The sample size, though adequate for detecting significant differences, limits the generalizability of the findings. Future research should aim to include larger and more diverse populations to validate these results. Additionally, longitudinal studies investigating the long-term impacts of BV on both maternal and neonatal health would provide a more comprehensive understanding of the condition.

## CONCLUSION

Our study demonstrates a significant association between bacterial vaginosis and preterm labor, along with poorer neonatal and maternal outcomes. These findings underscore the critical need for effective screening and management strategies for BV during pregnancy to improve health outcomes. By addressing this modifiable risk factor, healthcare providers can make significant strides in reducing the burden of preterm labor and enhancing the quality of care for both mothers and their infants.

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