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Identification and Predictors for Adverse Pregnancy Outcome in Women Presenting with Vaginal Discharge

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ABSTRACT
Background: *Abnormal vaginal discharge during pregnancy is frequently associated with infectious etiologies such as Candida spp., bacterial vaginosis (BV), and Trichomonas vaginalis, all of which have been implicated in adverse pregnancy outcomes (APOs). Early recognition of clinical and microbiological risk factors is essential for improving maternal-fetal health outcomes.*
Aim of the study: *This study aimed to identify the types of vaginal infections and evaluate independent predictors for adverse pregnancy outcomes among pregnant women presenting with abnormal vaginal discharge.*
Methods: *A cross-sectional study was conducted on 84 pregnant women presenting with abnormal vaginal discharge. Sociodemographic and clinical data were collected, and microbiological evaluation of discharge was performed. Adverse pregnancy outcomes, including preterm labor, PROM, low birth weight, IUGR, and neonatal complications, were documented. Logistic regression analysis was conducted to identify independent predictors for APOs.*
Result: *Candida spp. (42.86%) was the most commonly isolated organism, followed by bacterial vaginosis (23.81%) and Trichomonas vaginalis (10.71%). A total of 39.29% of women experienced composite APOs. The highest risk was associated with mixed infections (75.00%, p = 0.003), bacterial vaginosis (60.00%, p = 0.008), and Trichomonas vaginalis (55.56%, p = 0.041). Logistic regression revealed that low socioeconomic status (AOR 2.18, 95% CI: 1.01–4.92, p = 0.047), gestational age <34 weeks (AOR 2.46, 95% CI: 1.01–5.99, p = 0.049), bacterial vaginosis (AOR 2.51, 95% CI: 1.01–6.27, p = 0.049), and mixed infections (AOR 4.21, 95% CI: 1.01–19.8, p = 0.042) were independent predictors of APOs.*
Conclusion: *Vaginal infections, particularly bacterial vaginosis and mixed infections, significantly increase the risk of adverse pregnancy outcomes. Routine screening and prompt management of abnormal vaginal discharge during pregnancy may mitigate these risks and improve maternal-fetal outcomes.*
Keywords: *Vaginal discharge, bacterial vaginosis, mixed infection, pregnancy complications, adverse pregnancy outcomes, predictors.*

I. INTRODUCTION

Vaginal discharge is a common physiological occurrence during pregnancy, driven by increased vascularity, estrogen levels, and glandular secretions in the reproductive tract [1]. However, when the discharge becomes abnormal—characterized by changes in color, odor, consistency, or associated symptoms such as itching or irritation—it often signals underlying infections that may adversely affect both maternal and fetal outcomes [2]. Globally, abnormal vaginal discharge is reported in approximately 12.1% to 30% of pregnant women, with variation depending on population, region, and diagnostic criteria used [3]. Among the leading etiological factors, bacterial vaginosis (BV), vulvovaginal candidiasis, and trichomoniasis are the most frequently diagnosed infections in pregnancy [4]. BV alone affects an estimated 23–29% of women of reproductive age worldwide, with prevalence rates peaking in resource-limited settings due to poor hygiene, limited access to antenatal care, and inadequate screening protocols [5]. These infections disrupt the normal vaginal flora, particularly through the depletion of protective Lactobacillus species, resulting in an overgrowth of pathogenic anaerobes [6]. Importantly, several studies have consistently shown that the presence of infections during pregnancy is significantly linked to a variety of adverse pregnancy outcomes. These include preterm birth, low birth weight, intrauterine growth restriction (IUGR), premature rupture of membranes (PROM), spontaneous abortion, and postpartum

endometritis. Such complications not only affect fetal growth and development but also increase the risk of maternal morbidity, highlighting the need for early diagnosis and appropriate management of infections during pregnancy [7]. The pathophysiological mechanisms underlying these outcomes are multifactorial and include microbial invasion of fetal membranes, inflammatory cytokine production, and ascending infections leading to chorioamnionitis [8]. Despite the recognized burden of vaginal infections and their consequences, many cases remain undiagnosed or inadequately treated, especially in lower-income regions where routine antenatal screening for genitourinary infections is often unavailable or inconsistently implemented [9]. Moreover, sociocultural factors may lead to underreporting of symptoms, thereby delaying diagnosis and intervention [10]. Recent research has emphasized the importance of identifying modifiable and non-modifiable predictors for adverse outcomes in this population, including maternal age, parity, socio-economic status, previous obstetric history, co-existing sexually transmitted infections, hygiene practices, and timing of presentation during gestation [7,11]. The early recognition of these risk factors could aid in the development of structured antenatal screening models tailored to high-risk groups, improving timely diagnosis and targeted therapy [12]. Additionally, improved public health education, availability of rapid diagnostic tests, and the integration of reproductive health services at the community level could mitigate the long-term complications of undiagnosed infections [13]. Despite the growing body of literature, gaps remain in understanding the precise predictors and relative risks of adverse outcomes among women presenting with vaginal discharge during pregnancy, particularly in diverse ethnic and geographical contexts [14]. In this study, we aimed to explore these critical associations by identifying the predictors of adverse pregnancy outcomes in women who present with vaginal discharge.

II. METHODOLOGY & MATERIALS

This was a prospective observational study conducted at the Department of Obstetrics and Gynecology, Rangpur Community Medical College Hospital, Rangpur, Bangladesh from January 2024 to December 2024. The study was approved by the Institutional Ethics Committee and informed written consent was obtained from all participants prior to enrollment.

Inclusion and Exclusion criteria

A total of 84 pregnant women presenting with complaints of vaginal discharge were consecutively recruited. Inclusion criteria were: confirmed intrauterine pregnancy, presence of vaginal discharge requiring clinical evaluation, and willingness to participate. Exclusion criteria included: women with active labor, those with known immunosuppressive conditions, recent antibiotic or antifungal therapy (within the past 2 weeks), multiple gestations, or pregnancies complicated by fetal anomalies.

Data Collection and Clinical Evaluation

Comprehensive data collection was performed for all pregnant women enrolled in the study. Sociodemographic variables including age, parity, gestational age, body mass index (BMI), and socioeconomic status were documented. Obstetric history focused on prior miscarriages, preterm deliveries, and any complications in the current pregnancy. Clinical assessment included a detailed evaluation of symptoms related to vaginal discharge such as itching, dysuria, and abdominal pain, as well as characterization of the discharge by color, consistency, and odor. Under strict aseptic conditions, two high vaginal swabs were obtained from the posterior fornix of each participant using a sterile speculum. One swab was subjected to microscopic examination and Gram staining for the identification of bacterial vaginosis (using Nugent criteria), fungal elements, and protozoa. The second swab was cultured on Sabouraud dextrose agar and blood agar to isolate fungal and bacterial pathogens, including *Candida* species, *Gardnerella vaginalis*, and *Trichomonas vaginalis*. Adverse pregnancy outcomes (APOs) were defined as the occurrence of one or more of the following: preterm labor (<37 weeks gestation), premature rupture of membranes (PROM), low birth weight (<2500 g), intrauterine growth restriction (IUGR), antepartum hemorrhage, preeclampsia/eclampsia, intrauterine fetal demise (IUFD), stillbirth, neonatal intensive care unit admission, and neonatal sepsis. A composite APO variable was used to capture any of these adverse events during pregnancy or delivery.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 26. Continuous variables were summarized as means ± standard deviations, and categorical variables as frequencies and percentages. Chi-square tests were used to evaluate associations between vaginal infection types and APOs. Variables with $p < 0.10$ in univariate analysis were included in multivariate logistic regression models to identify independent predictors of APOs. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were reported. A p-value <0.05 was considered statistically significant.

III. RESULT

A total of 84 pregnant women were enrolled in the study. The mean age was 26.8 ± 4.2 years, with most women aged between 25 and 34 years. The mean Body Mass Index (BMI) was 26.71 ± 2.53 kg/m². Slightly more participants were primigravida. The average gestational age at presentation was 28.3 ± 6.7 weeks, with the majority in their third trimester. More than half (54.76%) belonged to the low socioeconomic group and A quarter (25%) had a prior miscarriage, and a smaller portion (14%) had a history of preterm birth. Symptoms accompanying vaginal discharge included itching, dysuria, and abdominal pain. The most common discharge types were white curdy and brownish (45.24%), followed by greenish or foul-smelling (29.76%) and watery types (25%) (Table 1). Microbiological analysis identified *Candida* spp. in the highest proportion (42.86%), followed by Bacterial vaginosis (Gardnerella) (23.81%), Trichomonas vaginalis (10.71%), and mixed infections (9.52%). Some cases yielded no growth or only normal flora (13.10%) (Table 2). Table 3 showed that obstetric complications and adverse pregnancy outcomes were common. 26.19% experienced preterm labor, making it the most common complication. PROM was reported in 17.86% of cases, and 22.62% delivered low birth weight infants (<2500 g). IUGR was identified in 13.10% of pregnancies. APH occurred in 7.14% of women, while hypertensive disorders such as preeclampsia or eclampsia were noted in 4.76%. Regarding neonatal outcomes, 15.48% of newborns required NICU admission, and 8.33% developed neonatal sepsis. Among women with Candida spp. infections 38.89% had APOs (p=0.035). A higher rate was seen in those with bacterial vaginosis (60.00%), and in Trichomonas vaginalis infections, 55.56% experienced APOs (p=0.041). The highest rate occurred in mixed infections, where 75.00% were affected (p=0.003). In contrast, only 18.18% of women with no microbial growth or normal flora experienced APOs, serving as the reference group (Table 4). Table 5 presented that after adjusting for confounders, low socioeconomic status was significantly associated with increased risk, with an adjusted odds ratio (OR) of 2.18 (95% CI: 1.01–4.92; p=0.047). Gestational age less than 34 weeks also showed a significant association, with an adjusted OR of 2.46 (95% CI: 1.01–5.99; p=0.049). Among vaginal infections, bacterial vaginosis was an independent predictor of adverse outcomes, with an adjusted OR of 2.51 (95% CI: 1.01–6.27; p=0.049). Mixed infections demonstrated the strongest association, with an adjusted OR of 4.21 (95% CI: 1.01–19.8; p=0.042).

Table 1: Sociodemographic and clinical characteristics of the study population (N = 84).

Variables	Frequency (n)	Percentage (%)
Age (years)		
<25	32	38.10
25–34	40	47.62
≥35	12	14.29
Mean +SD	26.8 ± 4.2	
BMI [kg/m2]		
Mean +SD	26.71 ± 2.53	
Parity		
Primi	44	52.38
Multi	40	47.62
Gestational Age (weeks)	28.3 ± 6.7	
Trimester		
First (<13 weeks)	10	11.90
Second (13–27 weeks)	34	40.48
Third (>27 weeks)	40	47.62
Socioeconomic status		
Low	46	54.76
Middle	30	35.71
High	8	9.52
History of previous miscarriage	21	25.00
History of preterm birth	14	16.67
Symptoms with discharge		
Itching	55	65.48
Dysuria	29	34.52
Abdominal pain	22	26.19
Type of discharge		
White curdy	38	45.24
Greenish/foul-smelling	25	29.76
Watery	21	25.00
Brownish	38	45.24

Table 2: Microbiological profile of vaginal discharge among the study population.

Organism Isolated	Frequency (n)	Percentage (%)
Candida spp.	36	42.86
Bacterial vaginosis (Gardnerella)	20	23.81
Trichomonas vaginalis	9	10.71
Mixed infection	8	9.52
No growth / Normal flora	11	13.10

Table 3: Obstetrical complications and adverse pregnancy outcomes among the study population (n = 84).

Adverse Outcome	Frequency (n)	Percentage (%)
Preterm labor (<37 weeks)	22	26.19
Premature rupture of membranes (PROM)	15	17.86
Low birth weight (<2500 g)	19	22.62
Intrauterine growth restriction (IUGR)	11	13.10
Antepartum hemorrhage (APH)	6	7.14
Preeclampsia/Eclampsia	4	4.76
Intrauterine fetal demise (IUFD)	3	3.57
Stillbirth	3	3.57
Neonatal intensive care admission	13	15.48
Neonatal sepsis	7	8.33
Composite adverse pregnancy outcome (APO)	33	39.29

Table 4: Association between type of vaginal infection and adverse pregnancy outcomes among the study population.

Type of Vaginal Infection	Total Cases (n)	Composite Adverse Outcome n (%)	p-value
Candida spp.	36	14 (38.89)	0.035
Bacterial vaginosis	20	12 (60.00)	0.008
Trichomonas vaginalis	9	5 (55.56)	0.041
Mixed infection	8	6 (75.00)	0.003
No growth / Normal flora	11	2 (18.18)	Reference

Table 5: Logistic regression for predictors of adverse pregnancy outcomes (n = 84).

Variable	Crude OR (95% CI)	Adjusted OR (95% CI)	p-value
Age >30 years	1.58 (0.72–3.48)	1.32 (0.54–3.18)	0.54
Low socioeconomic status	2.34 (1.02–5.35)	2.18 (1.01–4.92)	0.047
Gestational age <34 weeks	2.79 (1.24–6.25)	2.46 (1.01–5.99)	0.049
Candida infection	1.04 (0.45–2.38)	0.96 (0.38–2.41)	0.92
Bacterial vaginosis	2.88 (1.12–7.38)	2.51 (1.01–6.27)	0.049
History of preterm delivery	2.67 (1.01–7.04)	2.13 (0.91–6.18)	0.078
Mixed infection	4.83 (1.06–21.9)	4.21 (1.01–19.8)	0.042

IV. DISCUSSION

Adverse pregnancy outcomes associated with vaginal discharge can manifest in various forms, including preterm birth, low birth weight, and intrauterine infection, each influenced by distinct underlying predictors [15]. This study evaluated the sociodemographic, microbiological, and obstetric characteristics of pregnant women presenting with abnormal vaginal discharge, focusing on the association between specific vaginal infections and adverse pregnancy outcomes (APOs). The majority of the study population was between 25–34 years of age (47.62%) with a mean age of 26.8 ± 4.2 years, aligning with the reproductive age group most at risk for reproductive tract infections (RTIs), where the highest RTI prevalence (63.6%) was among women aged 25–34 years, with a statistically significant association ($P < 0.001$) [16]. Approximately 54.76% of participants belonged to a low socioeconomic background, which was significantly associated with higher risk of adverse pregnancy outcomes (Adjusted OR: 2.18; 95% CI: 1.01–4.92; $p = 0.047$), reinforcing evidence that socioeconomic disadvantage contributes to poor maternal health outcomes due to limited access to healthcare, hygiene, and education [17]. Microbiological analysis revealed Candida spp. as the most prevalent organism (42.86%), followed by Bacterial vaginosis (BV) (23.81%), Trichomonas vaginalis (10.71%), and mixed infections (9.52%). These results are consistent with global reports where Candida and BV are the predominant causes of symptomatic vaginal discharge during pregnancy [4]. The prevalence of BV in our population (23.81%) is similar to that reported by Regassa et al., who found BV in 25.4% of pregnant women in a large cohort study [18]. The most common presenting symptoms were vaginal itching (65.48%), dysuria (34.52%), and abdominal pain (26.19%), correlating with patterns reported by Prasad et al., who found dysuria as the most common symptom (32.5%), followed by itching (27.5%) and lower abdominal pain (9%) [19]. Our study found that 39.29% of pregnant women experienced composite adverse pregnancy outcomes (APOs), with preterm labor (26.19%) and low birth

weight (22.62%) being the most common complications. This is in line with the systematic review by Hillier et al., which demonstrated that bacterial vaginosis is associated with increased risk of spontaneous preterm birth [20]. Notably, BV (Adjusted OR: 2.51; 95% CI: 1.01–6.27; p = 0.049) and mixed infections (Adjusted OR: 4.21; 95% CI: 1.01–19.8; p = 0.042) were significantly associated with composite APOs, whereas Candida infection was not significantly associated (p = 0.92). These findings are supported by Gigi et al., who concluded in their meta-analysis that Candida infection is less strongly correlated with adverse outcomes compared to BV and Trichomonas [21]. Additionally, early gestational age at presentation (<34 weeks) was a significant predictor of APOs (Adjusted OR: 2.46; 95% CI: 1.01–5.99; p = 0.049), highlighting the need for early detection and management of vaginal infections during pregnancy. This observation echoes results from a prospective cohort by Hay et al. who found that patients who diagnosed with vaginal infections (BV) before 16 weeks' gestation had a significantly increased risk of preterm delivery or late miscarriage (Odds Ratio: 5.5; 95% CI: 2.3–13.3; p < 0.001), which demonstrated increased risks of preterm labor with early-onset bacterial vaginosis [22]. The presence of Trichomonas vaginalis also showed a significant association with APOs (p = 0.041), aligning with earlier findings by Cotch et al. (1997), who demonstrated that Trichomonas increases the risk of premature rupture of membranes and preterm delivery [23]. Interestingly, women with no identifiable infection or those with normal flora had the lowest rate of APOs (18.18%), reinforcing the idea that vaginal dysbiosis plays a critical role in pregnancy complications. These findings emphasize the importance of timely microbial diagnosis and appropriate treatment [24].

Limitations of the study: This single-center study had a relatively small sample size (n=84), which may limit the generalizability of findings to broader populations. The absence of longitudinal follow-up post-delivery restricted assessment of long-term neonatal outcomes. Additionally, reliance on conventional microbiological techniques may have underestimated polymicrobial or fastidious infections. Sociocultural barriers could have led to underreporting of symptoms, potentially introducing selection bias. Finally, potential confounders such as sexual behavior, hygiene practices, and partner treatment were not thoroughly assessed.

V. CONCLUSION AND RECOMMENDATIONS

In the present study, nearly 40% of pregnant women presenting with abnormal vaginal discharge experienced adverse pregnancy outcomes, highlighting the clinical relevance of this symptom. Microbiological evaluation revealed that infections, particularly bacterial vaginosis and mixed vaginal infections, were strongly associated with poor obstetric outcomes. Moreover, socioeconomic disadvantage and lower gestational age at presentation independently predicted risk for APOs. These findings underscore the need for comprehensive antenatal screening for genital tract infections, especially among socioeconomically disadvantaged women. Early identification and targeted treatment could serve as effective strategies to reduce the burden of preterm birth, low birth weight, and neonatal morbidity in this high-risk population.

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