Epidemiology and Clinico-Investigative Study of Abnormal Vaginal Discharge During Pregnancy

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ABSTRACT

Objective: This study aimed to determine the prevalence, clinical presentation, microbiological causes, antibiotic and anti-fungal sensitivity patterns, and pregnancy impacts of vaginal infections manifesting as abnormal discharge among pregnant women.

Study design: A cross-sectional study.

Patients and Methods: The study included 303 pregnant women with vaginal discharge attending an antenatal clinic. Symptoms were recorded and vaginal swabs underwent microbiological testing. Bacterial isolates were subject to antibiotic sensitivity testing.

Results: Bacterial vaginosis (41.6%) was the most common infection followed by candidiasis (39.9%) and trichomoniasis (6.9%). Symptoms included vulvar irritation (51.8%), lower abdominal pain (54.5%), and purulent discharge (64.5%). Staphylococcus aureus, Escherichia coli and Klebsiella pneumoniae were frequently isolated. Antibiotic resistance was emerging. Bacterial vaginosis was associated with preterm birth, low birth weight, and other adverse outcomes. Among Candida isolates, greater sensitivity to micafungin and caspofungin versus fluconazole was exhibited.

Conclusion: Vaginal infections are highly prevalent among pregnant women and increasing antibiotic resistance is concerning. Screening and treatment of bacterial vaginosis is vital for preventing poor maternal-fetal outcomes. Further research into optimal antibiotic and antifungal choices is warranted.

Key Words: Candida, bacterial vaginosis, trichomoniasis, vaginal discharge, vaginal infection.

INTRODUCTION

Pregnancy is a complex physiological state characterized by numerous changes in the woman's body to support the developing fetus. Among the various challenges faced by pregnant women, abnormal vaginal discharge emerges as a common concern that requires thorough investigation[1]. Vaginal discharge is a normal and essential part of the female reproductive system, serving to maintain the pH balance and prevent infections. However, alterations in the quantity, consistency, color, or odor of vaginal discharge during pregnancy can be indicative of underlying conditions that necessitate attention and clinical evaluation[2].

Furthermore, a clinico-investigative approach is crucial to differentiate between physiological changes and pathological conditions causing abnormal vaginal discharge during pregnancy. Additionally, exploring the psychosocial aspects of abnormal vaginal discharge during pregnancy is essential, as it can impact the mental well-being of expectant mothers[3].

Vaginitis, particularly vulvovaginitis, poses a significant public health concern among women of childbearing age. This condition, characterized by infections, inflammation, or changes in flora, includes common types such as bacterial vaginosis (BV), trichomoniasis, and candidiasis. BV, prevalent in reproductive-age women, manifests as thin, milky discharge with a fishy odor. Trichomoniasis results in frothy, greenish-yellow discharge with a foul smell[4].

Vaginal candidiasis, the second most common vaginal infection globally, affects over 75% of women at least once in their lifetime, with a 50% recurrence rate. While 75% of candidiasis cases are asymptomatic, symptomatic presentations include itching, pain, burning sensation, dyspareunia, dysuria, erythema, vulvar edema, and cheesy discharge. During pregnancy, the risk of VulvoVaginal Candidiasis (VVC) increases by 30%, correlating with adverse outcomes like abortion, intrauterine infection, fetal growth retardation, preterm birth, low birth weight, and puerperal infection[5].

This study aims to contribute valuable insights into the epidemiology and clinico-investigative aspects of abnormal vaginal discharge during pregnancy. By elucidating the prevalence, associated risk factors, and clinical manifestations.

PATIENTS AND METHODS

The research conducted is a cross-sectional study set in the Women Health Hospital at Assiut University, Egypt, from December 2020 to June 2023. The study focused on pregnant women aged 19-40, examining the prevalence and characteristics of abnormal vaginal discharge during pregnancy at any gestational age.

The study did not include: Pregnant women in labor, those with current vaginal bleeding, those with current PROM, immunocompromised women, patients refused to participate.

Microbiological Examination was done for vaginal discharge of participated women.

various techniques were employed. For Candida, methods such as KOH preparation, Gram-stained smears, and cultures on Sabouraud's dextrose agar were utilized. Trichomoniasis (TV) was investigated through a wet mount preparation, while Bacterial Vaginosis (BV) involved the Whiff amine test, wet film examination, and Gram-stained smears.

RESULTS

This study included 303 pregnant women with vaginal discharge attending an antenatal clinic.

(Table 1) summarizes demographic data for 303 pregnant women, covering age, residence, employment, education, prior treatment, history of vaginal wash use, and recurrence rate. The majority (53.8%) were aged 20-24, with 22.4% falling in the 25-30 age group. Rural residency was predominant (63.7%), and 64.4% were employed. Education levels varied, with 35.0% being illiterate. Only 7.3% had received prior treatment for vaginal infections, and 14.5% had used vaginal wash. The average recurrence rate was 0.30 ±0.97.

Table 1: Demographic data among pregnant women

Variables		Pregnant (N=303)	
		N	%
Age (years)	20-24 yrs.	163	53.8%
	25-30 yrs.	68	22.4%
	31-35 yrs.	57	18.8%
	36-40 yrs.	15	5.0%
Residence	Urban	110	36.3%
	Rural	193	63.7%
Patients work	Housewife	108	35.6%
	Working	195	64.4%
Education	Illiterate	106	35.0%
	Primary	128	42.2%
	secondary or more	69	22.8%
Previous treatment		22	7.3%
Previous use of vaginal wash		44	14.5%
No. of recurrence		0.30 ±0.97	

(Table 2) outlines clinical information for 303 pregnant women in the study, detailing symptoms and signs. Dysuria (painful urination) was reported by 36.3%, while dyspareunia (painful intercourse) affected 17.8%. Abnormal vaginal discharge included 152 patients of the 303, with curdy white discharge reported by 73.0% of them, frothy discharge reported by 17.8%, and 9.2% with yellowish green discharge. Pruritus vulva (itching) was reported by 51.8%, and 54.5% experienced lower abdomen pain. Vaginal erythema (inflammation) was noted by 19.5%. Nature of the abnormal discharge the revealed 10.5% excessive, 25.0% malodorous, and 64.5% purulent discharge of the 152 patients complaining of the discharge.

Table 2: Clinical picture among pregnant women

Variables	Pregnant (N=303)	
Symptoms	N	%
Dysuria	110	36.3%
Dyspareunia	54	17.8%
Abnormal vaginal discharge	(N=152)	(50.2%)
Curdy white	111	73.0%
Frothy	27	17.8%
Homogeneous green	14	9.2%
Pruritus vulva	157	51.8%
Lower abdomen pain	165	54.5%
Signs	N	%
Vaginal erythema	59	19.5%
Nature of the discharge	(N=152)	(50.2%)
Excessive	16	10.5%
malodour	38	25.0%
purulent	98	64.5%

(Table 3) outlines key findings from routine laboratory investigations and the microbiological spectrum of vaginal swabs in the 303 participating pregnant women. Results showed that 83.8% had a normal complete blood picture, indicating the absence of anemia or blood-related disorders. Pyuria in urine analysis was observed in 5.3%, suggestive of urinary tract infections. Most women (95.3%) exhibited normal random blood glucose levels, excluding gestational diabetes. CRP levels averaged at 5.43 ± 2.43, indicating a potential underlying inflammatory process. Microbiological analysis revealed bacterial vaginosis as the most prevalent infection (41.6%), followed by candidiasis (39.9%), and trichomonas vaginitis (6.9%). Mixed infections affected 5.9% of women, while 5.6% showed no microbial growth.

Table 3: Routine laboratory investigations and microbiological spectrum of vaginal swabs among pregnant women

Variables		Pregnant (N=303)	
Routine laboratory investigations		N	%
Normal complete blood picture		254	83.8%
Pyuria in urine analysis		16	5.3%
Normal random blood glucose		289	95.3%
CRP		5.43 ±2.43	
Microbiological spectrum of vaginal swab		N	%
	Bacterial vaginosis	126	41.6%
	Trichomonas vaginitis	21	6.9%
Vaginal swab	Candidiasis	121	39.9%
	Mixed	18	5.9%
	no growth	17	5.6%

The antibiotic sensitivity analysis, presented in (Table 4) for bacterial species isolated from vaginal swabs of pregnant women, provides valuable insights into the susceptibility patterns of various bacteria to different antibiotics. Notably, Staphylococcus aureus displayed varying sensitivity profiles across antibiotics, with higher efficacy observed for Ciprofloxacin (91.7%). Streptococcus pyogenes exhibited sensitivity to a range of antibiotics, including Ceftazidime (70.0%) and Amikacin (70.0%). Escherichia coli demonstrated broad sensitivity effectiveness against Ciprofloxacin (88.6%) and Gentamicin (91.4%). Enterobacter cloacae with notable sensitivity against Trimethoprim/sulfamethoxazole (83.3%) and gentamicin (83.3%). Klebsiella pneumonia with highest sensitivity to Amikacin (83.3%) and Gentamicin (83.3%). Pseudomonas aeruginosa, while resistant to certain antibiotics, exhibited high sensitivity to Ciprofloxacin (88.9%) and Levofloxacin (88.9%).

In (Figure 1), the analysis reveals the rates of bacterial species isolated from vaginal swabs of pregnant women. Staphylococcus aureus, identified in 28.6% of samples, along with Escherichia coli (27.8%) and Klebsiella pneumoniae (19.0%), represent predominant species associated with various infections during pregnancy. Streptococcus pyogenes and Enterococcus were less frequently isolated at 7.9% and 9.5%, respectively. Pseudomonas aeruginosa, found in 7.1% of samples.

(Figure 2) details the sensitivity of Candida isolates from vaginal swabs to various antifungal agents. Among the 121 Candida isolates, 40.5% exhibited sensitivity to fluconazole, 72.7% to voriconazole, 95.0% to caspofungin, 97.5% to micafungin, and 77.7% to amphotericin B. The highest sensitivities were observed for micafungin and caspofungin, reaching 97.5% and 95.0%, respectively.

Table 4: Bacterial species isolates sensitivity from vaginal swabs among pregnant women:

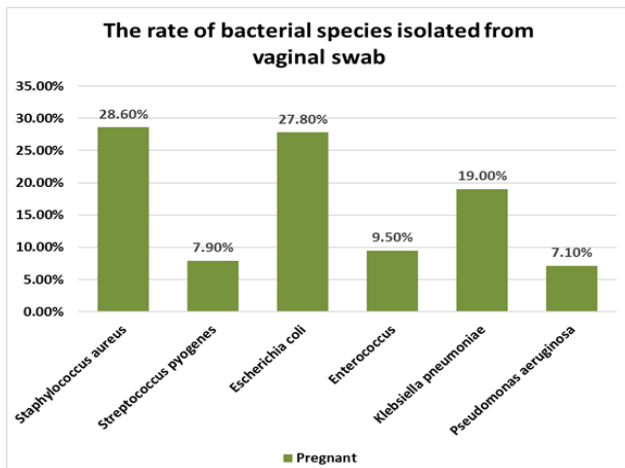| Sensitivity to antibiotics	Staphylococcus aureus (n=36)		Strepto-coccus pyogenes (N=10)		Escherichia coli (N=35)		Enterobacter cloacae (N=12)		Klebsiella pneumoniae (N=24)		Pseudomonas aeruginosa (N=9)	
	n	%	n	%	n	%	n	%	N	%	n	%
Ampicillin	2	5.6%	1	10.0%	3	8.6%			R		R	
Cefazolin	24	66.7%	5	50.0%	3	8.6%	1	8.3%	13	54.2%	R	
Cefoxitin	23	63.9%	7	70.0%	14	40.0%	1	8.3%	13	54.2%	R	
Ceftazidime	31	86.1%	7	70.0%	21	60.0%	8	66.7%	15	62.5%	7	77.8%
Ceftriaxone	24	66.7%	5	50.0%	23	65.7%	9	75.0%	12	50.0%	R	
Cefepime	24	66.7%	7	70.0%	23	65.7%	8	66.7%	13	54.2%	7	77.8%
Amikacin	30	83.3%	7	70.0%	31	88.6%	9	75.0%	20	83.3%	6	66.7%
Gentamicin	29	80.6%	7	70.0%	32	91.4%	10	83.3%	20	83.3%	5	55.6%
Ciprofloxacin	33	91.7%	4	40.0%	31	88.6%	9	75.0%	19	79.2%	8	88.9%
Levofloxacin	20	55.6%	6	60.0%	31	88.6%	9	75.0%	19	79.2%	8	88.9%
Nitrofurantoin	19	52.8%	4	40.0%	29	82.9%	7	58.3%	20	83.3%	1	11.1%
Trimethoprim/ Sulfamethoxazole	1	2.8%	1	10.0%	5	14.3%	10	83.3%	4	16.7%	R	
Tetracycline	R		R				9	75.0%				
Clindamycin	R		R				8	66.7%				

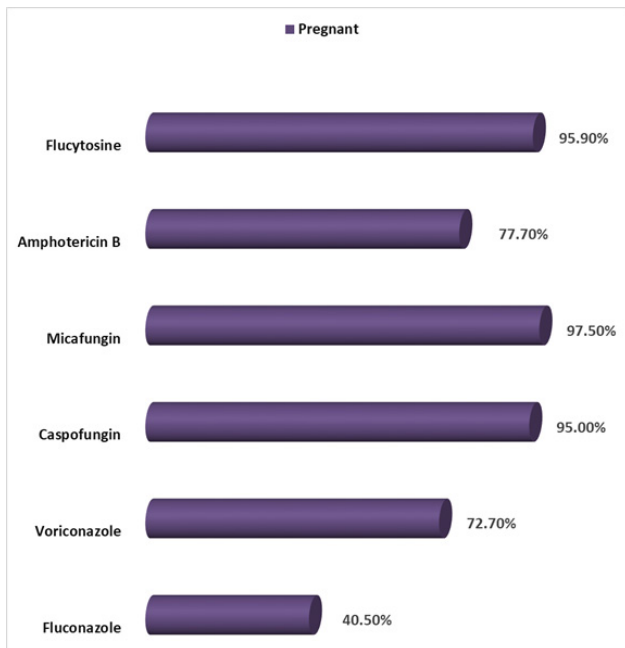**Fig. 1:** The rate of bacterial species isolated from vaginal swabs among pregnant women

Fig. 2: Candida isolates sensitivity from vaginal discharge among pregnant women

(Figure 3) illustrates the distribution of patients participated across trimesters of pregnancy, revealing that the majority (72%) were in their third trimester, while 14% were in both first and second trimesters.
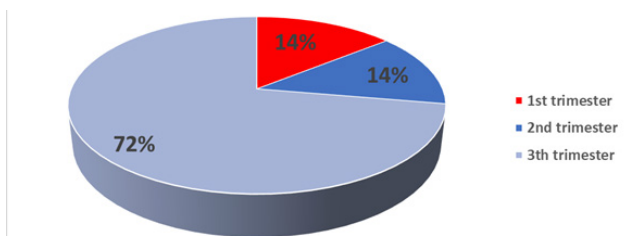

Fig. 3: Gestational trimester among pregnant women

In (Figure 4), the results highlight a significant association between bacterial vaginosis (BV) and adverse maternal and fetal outcomes. Women with BV exhibited a higher risk of preterm birth, premature rupture of membranes, low birthweight and neonatal intensive care unit (NICU) admission compared to women without BV. These findings underscore the potential implications of BV on pregnancy outcomes.
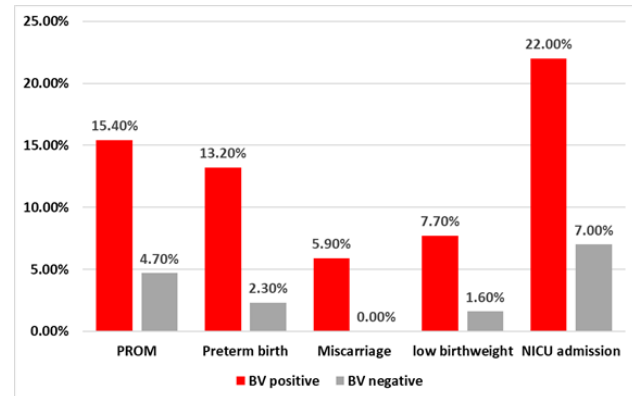

Fig. 4: Maternal and fetal outcomes in women with bacterial vaginosis

DISCUSSION

Abnormal vaginal discharge is a common problem among women of reproductive age. Bacterial vaginosis (BV) is the most common microbiological cause. Ongoing studies are investigating the prevalence, causes, and treatments of abnormal discharge during pregnancy[1]. The current study aimed to determine the prevalence of different vaginal infections causing abnormal discharge in pregnant women, the clinical presentation of common organisms, and their antimicrobial sensitivity.

In present study, of 303 pregnant women, 36.3% reported painful urination; 17.8% painful sex. Abnormal vaginal discharge included 152 patients of the 303: 73% curdy white, 17.8% frothy, 9.2% yellow green. 51.8% had vulvar itching. 54.5% had lower abdominal pain. 19.5% had vaginal inflammation. Nature of the abnormal discharge was excessive in 10.5%, malodorous in 25%, and purulent in 64.5% of the 152 patients complaining of the discharge.

This finding is in accordance with (Singamsetty and Sravani, 2021)[6] noticed that 50.61% had vulvar itching. Discharge characteristics were also similar with 61.25% curdy, 16.25% frothy, 17.5% green. Dysuria prevalence was lower at 47.5% vs 36.3% here. Lower abdomen pain was comparable at 55% vs 54.5%. The nature of discharge aligned with 30% excessive, 18.75% malodorous, and 45% purulent. Hillier *et al*.[7] reported 36% had vaginal pruritus, partially supporting the 51.8% prevalence here.

Our results found that of 303 pregnant women, most had normal blood work: 83.8% normal blood picture, 95.3% normal blood glucose. 5.3% had pyuria suggesting UTIs. Average CRP was 5.43 ± 2.43, indicating inflammation. Microbiology: 41.6% had bacterial vaginosis; 39.9% candidiasis; 6.9% trichomonas vaginitis. 5.9% had mixed infections. 5.6% no microbial growth.

Vaginal WBCs can indicate bacterial vaginosis or cervicitis (Shroff, 2023)[8]. Pyuria diagnoses urinary tract infections (Elkins *et al.*, 2020)[9]. BV is considered noninflammatory but elevates WBCs, possibly indicating concurrent infections (Nyirjesy, 2014; Shroff, 2023)[8,10]. PID and BV increase CRP levels (González-Fernández *et al.*, 2017)[11] while candidiasis, trichomoniasis or BV lower vaginal CRP (Tokmak *et al.*, 2015)[12].

Our study found that Staphylococcus aureus (28.6%), Escherichia coli (27.8%), and Klebsiella pneumoniae (19.0%) were the predominant bacterial species isolated from vaginal swabs of pregnant women. Streptococcus pyogenes (7.9%), Enterococcus (9.5%), and Pseudomonas aeruginosa (7.1%) were less frequently found.

Aligning with the current study, Singamsetty, Venugopal, Gandhi, and Shanmugam[6,13,14] found bacterial vaginosis as the most prevalent vaginal infection (27-47%), followed by candidiasis (6.25-29.75%) and trichomoniasis (4.3-25%). Mixed infections affected 3-13.75%. Prevalence ranges widely - Konadu[2] reported BV between 6-54%. Olowe[4] found lower rates in pregnant Nigerian women (BV 20%, candidiasis 26.7%, trichomoniasis 4.3%). Microbiological causes and prevalence are variable but generally rank BV, then candidiasis, then trichomoniasis.

Our study found that S. aureus was highly sensitive to Ciprofloxacin (91.7%). S. pyogenes showed sensitivity to Ceftazidime (70%) and Amikacin (70%). E. coli was broadly sensitive, especially to Ciprofloxacin (88.6%) and Gentamicin (91.4%). Enterobacter was susceptible to Trimethoprim/sulfamethoxazole (83.3%) and gentamicin (83.3%). Klebsiella pneumonia was highly sensitive to Amikacin (83.3%) and Gentamicin (83.3%). Pseudomonas aeruginosa was sensitive to Ciprofloxacin (88.9%) and Levofloxacin (88.9%).

Similar to the current findings, Mohammed and Hamadamin[15] found high sensitivity of S. aureus to ciprofloxacin (100%) and S. pyogenes to amoxicillin (94.1%). AL-KRAETY[16] showed Klebsiella sensitivity to ciprofloxacin and gentamycin but resistance to ampicillin. Bitew and Javed[17] also found S. aureus sensitive to ciprofloxacin (93-95%) but resistant to erythromycin and trimethoprim/sulfamethoxazole while E. coli was resistant to trimethoprim/sulfamethoxazole (91.3-63.6%) but sensitive to ciprofloxacin (95.5%) and gentamycin (93%). Antibiotic resistance is concerning and facilitates ineffective bacterial vaginosis treatment.

The results show that of 121 Candida isolates from pregnant women, sensitivity was 40.5% for fluconazole, 72.7% for voriconazole, 95.0% for caspofungin, 97.5% for micafungin, and 77.7% for amphotericin B. Highest sensitivity was seen for micafungin (97.5%) and caspofungin (95.0%).

Shrestha[18] found 100% C. albicans sensitivity to miconazole and nystatin but lower for fluconazole (74.2%) and amphotericin B (67.7%). Intermediate resistance was seen for itraconazole (50%) and clotrimazole (22.6%). Similarly, Laal Kargar[19] found 95-93% sensitivity to nystatin and econazole. Rezaei-Matehkolaei[20] showed 100% sensitivity to amphotericin B, clotrimazole, nystatin and ketaconazole, Susceptibility patterns vary across antifungal agents.

Finally, in our result, bacterial vaginosis (BV) positive pregnant women had a higher risk of adverse maternal and fetal outcomes compared to BV negative pregnant women. BV positive pregnant women had a significantly higher risk of PROM, preterm birth, low birth weight, and NICU admission. The risk ratios for these outcomes were all statistically significant with p-values less than 0.05. However, there was no significant difference in the rate of miscarriage between BV positive and BV negative pregnant women. These findings suggest that BV may have negative impacts on both maternal and fetal health outcomes and highlight the importance of screening and treating BV during pregnancy.

Bacterial vaginosis (BV) during pregnancy has been associated with adverse maternal and fetal outcomes such as preterm birth, low birth weight, premature rupture of membranes, and early miscarriage[21]. A study showed that BV-positive women had a statistically significant higher rate of moderate preterm birth (below 34 weeks)[3]. Another study found that BV during pregnancy is a well-established risk factor for preterm birth and other preterm pregnancy complications[22]. If left untreated, BV can increase the risk of premature birth and low birth weight in babies[23].

It is important to note that most women identified as having bacterial vaginosis in early pregnancy are likely to have persistent infection later in pregnancy[21]. However, getting treated for BV during pregnancy can help protect the baby from adverse outcomes[23]. Screening for BV in pregnant women can also help prevent preterm delivery and other complications[4].

CONCLUSION

This study determined a high prevalence of abnormal vaginal discharge among pregnant women, most commonly due to bacterial vaginosis, candidiasis, and trichomoniasis. Symptoms like itching, pain, and purulent discharge were common. Staphylococcus aureus, E. coli, and Klebsiella

pneumonia were frequently isolated. Antibiotic sensitivity varied between bacteria but resistance was emerging. Bacterial vaginosis increased adverse maternal-fetal outcomes. Candida isolates exhibited greater sensitivity to micafungin and caspofungin versus fluconazole. These findings highlight the microbiological landscape, optimal treatments, and risks linked to vaginal infections in pregnant women.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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