Original Research

A STUDY ON MICROBIOLOGICAL PROFILE OF VAGINITIS AND ITS ASSOCIATION WITH URINARY TRACT INFECTION DURING PREGNANCY IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Lower genital tract infections (LGTIs) and urinary tract infections (UTIs) are common among pregnant women due to physiological, hormonal, and anatomical changes during pregnancy [1]. These infections are associated with adverse maternal and neonatal outcomes, including anemia, preterm labor, low birth weight and neonatal infections [2]. Early diagnosis and appropriate management are essential to reduce pregnancy-related complications and improve maternal health outcomes [3].

Objective: To study the common causes of infectious vaginitis in pregnancy and to determine the risk of Urinary Tract Infections in pregnant women with bacterial vaginosis in a tertiary care hospital.

Methods: This cross-sectional study was conducted at Government tertiary care hospital in Chennai ,Tamilnadu for a period of one year.

Results: Among 200 antenatal women, the prevalence of infectious vaginitis was 32.5%, most commonly affecting women aged 26–30 years. Bacterial vaginosis (21%) was the predominant infection, followed by vulvovaginal candidiasis (11.5%). UTIs were observed in 16% of patients, with higher prevalence in the third trimester. A significant association was found between bacterial vaginosis and UTI ($p<0.05$), whereas vulvovaginal candidiasis showed no significant association. Multidrug resistance was observed in 33% of urinary isolates. Candida albicans was the most common Candida species isolated, while *C.tropicalis* was the only Candida non albicans species isolated from urine specimens and was sensitive to all azoles and Nystatin B.

Conclusion: Bacterial vaginosis is the most common cause of vaginitis among pregnant women associated with adverse pregnancy outcomes. Routine screening and early treatment of vaginitis and UTIs during antenatal care may help reduce maternal and perinatal complications. The increasing prevalence of multidrug-resistant urinary isolates highlights the importance of culture-based diagnosis and judicious antibiotic use.

Keywords: Urinary Tract Infections, Bacterial Vaginosis, Vulvo Vaginal Candidiasis.

INTRODUCTION

Lower genital tract infections among women of reproductive age, particularly during pregnancy, are a significant global health concern. Although often asymptomatic, these infections can result in serious complications such as pelvic inflammatory disease, abortion, preterm labor, low birth weight, and increased risk of human immunodeficiency virus (HIV) acquisition, affecting both maternal and neonatal outcomes [2,3].

Vaginitis, characterized by abnormal vaginal discharge with itching and irritation, commonly includes bacterial vaginosis (BV), vulvovaginal candidiasis (VVC), and trichomoniasis [4]. BV results from disruption of normal Lactobacilli-dominant flora, leading to polymicrobial overgrowth and is associated with adverse pregnancy outcomes such as preterm labor and premature rupture of membranes [5]. Its prevalence in pregnancy ranges from 15–23%, with many cases remaining asymptomatic [6].

VVC, predominantly caused by Candida albicans, affects nearly 75% of women at least once in their

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lifetime [7]. Pregnancy, diabetes, and antibiotic use are key risk factors, with increasing antifungal resistance contributing to recurrent infections [8]. Trichomoniasis, caused by Trichomonas vaginalis, is associated with premature birth, low birth weight, infertility, cervical neoplasia, and increased HIV transmission risk [9].

Urinary tract infections are among the most common infections during pregnancy due to physiological and anatomical changes, including ureteric dilatation, urinary stasis, and glycosuria [1,10]. UTIs may present as symptomatic or asymptomatic bacteriuria, with prevalence ranging from 2–10% globally and 3–24% in India [11,12]. These infections are associated with complications such as anemia, hypertensive disorders, prematurity, and low birth weight [2,13].

An association exists between BV and UTIs, where reduced Lactobacilli and increased vaginal pH facilitate colonization of uropathogens from fecal flora. Considering the risks to both mother and fetus, early diagnosis and treatment are essential.

This study aims to determine the microbiological profile of vaginitis and evaluate the association between bacterial vaginosis and urinary tract infections in pregnant women attending a tertiary care hospital.

MATERIALS AND METHODS

This cross-sectional study was conducted at Government tertiary care hospital in Chennai, Tamilnadu for a period of one year. Approval for the study was obtained from the Institutional Ethical Committee, and written informed consent was obtained from all patients.

The pregnant women presenting with one or more of the following symptoms were included in the study: Increased vaginal discharge with foul smell, lower abdominal pain, itching or irritation in vagina, pain during sexual intercourse, dysuria, frequent urination with urgency or leaking of urine, burning sensation during urination, fever with chills and rigor. Antenatal women on antimicrobial drugs and with conditions such as placenta previa were excluded from the study.

Statistical analysis

Data was entered in Microsoft Excel and analyzed using SPSS version 26.0. Descriptive statistics such as frequencies and percentages were used to summarize demographic characteristics, prevalence of infections, microbial isolates, and antimicrobial susceptibility patterns. Associations between categorical variables were analyzed using the Chi-square test. Odds ratio (OR) was calculated to assess the strength of association between bacterial vaginosis and urinary tract infection. A p-value of <0.05 was considered statistically significant.

Case Definitions [14]

Symptomatic Urinary Tract Infection

Cystitis is defined as an inflammation of the urinary bladder. Urethritis is an inflammation of the urethra. Both are most commonly caused by a bacterial infection; in which case, they are also referred to as lower UTIs. Classic symptoms of lower UTIs are dysuria, urinary frequency, and supra pubic pain sometimes in combination with hematuria, but normally without fever.

Asymptomatic Bacteriuria

Asymptomatic bacteriuria refers to bacteriuria in patients with no clinical UTI symptoms. For women $\geq 10^5$ colony forming units (CFU) per ml in two consecutive clean-catch urine samples is required for the diagnosis of asymptomatic bacteriuria, whereas for men only one clean catch urine sample with $\geq 10^5$ CFU per mL is required—or a single catheterized urine specimen with one single bacterial strain of $\geq 10^2$ CFU per mL in women or men.

Specimen Collection and Processing

A total of 2 High vaginal swabs (HVS) were taken from each patient using sterile cotton tipped polyester (Himedia) swabs and a 5ml of clean catch midstream urine sample were collected in a sterile universal container.

Screening for Bacterial Vaginosis

This was done based on Amsel's criteria and Nugent's scoring.

Amsel's Criteria: It includes homogeneous vaginal discharge, pH of the vagina being > 4.5, the presence of clue cells in wet mount of the vaginal discharge and a positive whiff test. According to Amsel, if 3 of the 4 criteria are positive, the patient has bacterial vaginosis.

Nugent's Criteria: In this criterion, each Gram-stained smear was evaluated for the following morphotypes under oil immersion objective (l00x) by the following scheme:

- Large gram-positive rods: Lactobacillus morphotype.
- Small gram-negative rods: Gardnerella morphotype.
- Small gram variable rods: Bacteroides morphotype.
- Curved gram variable rods: Mobilincus morpholog

The Nugent Scoring System for Diagnosis of Bacterial Vaginosis			
Score	**Lactobacillus Morphotype Per Field**	**Gardnerella Morphotype Per Field**	**Curved Bacteria (Mobiluncus) Per Field**
0	>30	0	0
1	5-30	<1	<1-4
2	1-4	1-4	>5
3	<1	5-30	-
4	0	>30	-

Score:
- 0-3 = Normal/No BV
- 4-6 = Intermediate
- 7-10 = Bacterial vaginosis

Hvs and Urine Specimen Processing

The high vaginal swab specimens were examined by wet mount microscopy for the presence of clue cells and motile flagellates of *Trichomonas vaginalis* (TV). If detected, the specimens were further cultured on Diamond's medium. The HVS samples were also processed for aerobic bacterial and fungal culture by inoculation onto MacConkey agar, Blood agar and Sabouraud dextrose agar (SDA).

Urine samples were cultured on Cysteine Lactose Electrolyte Deficient (CLED) agar, and semiquantitative culture was performed using the standard loop method. The isolates were identified based on colony morphology and preliminary test such as Gram stain, catalase, oxidase, and motility by the hanging drop method. Additional biochemical test were carried out according to standard protocols. Antibiotic susceptibility testing of bacterial isolates was performed on Mueller- Hinton Agar (MHA) using the Kirby-Bauer disc diffusion method as per CLSI guidelines.

Candida isolates from high vaginal swab and urine were identified based on colony morphology on SDA and CHROM agar. Further identification was done using Gram staining, germ tube test, sugar fermentation and assimilation tests. Antifungal susceptibility testing for yeast isolates was performed using Mueller- Hinton Agar supplemented with 2% glucose and 0.5µg/ml methylene blue dye GMB medium as per CLSI guidelines.

RESULTS

A total of 200 antenatal women were included in the study. The majority of participants were in the age group 21–25 years (33.5%), followed by 26–30 years (29.5%). Vaginal discharge was the most common presenting complaint (77.5%), followed by lower abdominal pain (32.5%) and burning micturition (21%).

Figure: 1

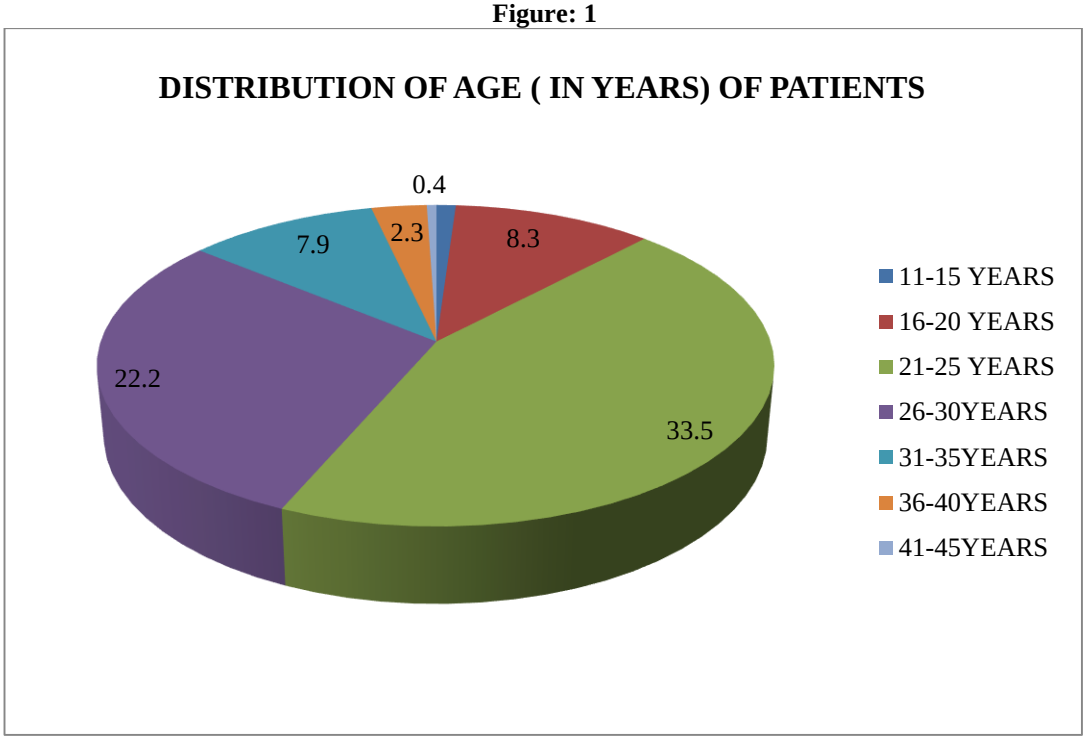


Figure 2

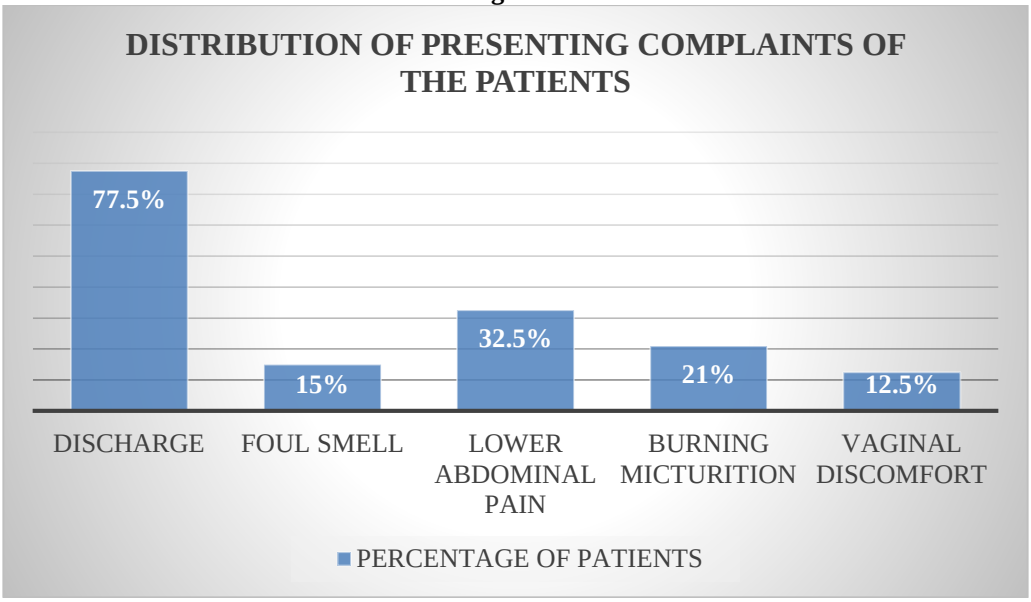


Table 1: Prevalence of Vaginitis and Uti

Type of Infections	No. of Positives (%) N=200
Bacterial vaginosis (BV)	42 (21.0)
Vulvovaginal candidiasis (VVC)	23 (11.5)
Urinary tract infection (UTI)	32 (16.0)

Among 200 study participants, bacterial vaginosis was the most common infection (21%), followed by vulvovaginal candidiasis (11.5%). The overall prevalence of vaginitis was 32.5%, while urinary tract infection was observed in 16% of cases.

Table 2: Trimester Wise Distribution of Infectious Vaginitis and Urinary Tract Infection

Trimester	Total Patients (N)	Vaginitis N (%)	Uti N (%)
I	32	9 (13.8%)	1 (3.1%)
II	99	31 (47.7%)	15 (46.9%)
III	69	25 (38.5%)	16 (50%)
Total	200	65 (32.5%)	32 (16%)
p-value	-	>0.05	<0.05

The higher rate of vaginal infection was found in 2nd trimester 31(47.7%) followed by 3rd trimester 25(38.5%). However, the difference was not statistically significant (p>0.05).

The higher rate of urinary tract infection was found in 3rd trimester of pregnancy 16(50%) followed by 2nd trimester 15(46.9%). The difference was statistically significant. (p<0.05)

Table 3: Association of Bacterial Vaginosis (Bv) with Uti during Pregnancy (N=200)

Diagnosis	Uti Present	Uti Absent	Total	Statistic Chi-Square Test
BV PRESENT	15	27	42	P<0.05
BV ABSENT	17	141	158	
TOTAL	32	168	200	

The above table shows that BV was present in 42 antenatal patients (21%) and UTI was present in 32 patients (16%). About 15 patients with BV (out of 42) had associated UTI. The association between BV and UTI was found to be statistically significant (p<0.05).The odds ratio (OR) for association between BV and UTI during pregnancy was found to be 4.6, indicating participants with BV had approximately 4.6-fold higher odds of developing UTI compared to those without BV (OR = 4.61; 95% CI: 2.06–10.33; P < 0.05), suggesting that BV is an important risk factor for UTI during pregnancy.

Table 4: Association of Vulvo Vaginal Candidiasis (Vvc) with Uti

Diagnosis	Uti Present	Uti Absent	Total	Statistic Chi Square Test
VVC PRESENT	4	19	23(11.5%)	P>0.05
VVC ABSENT	28	149	177(88.5%)	
TOTAL	32	168	200	

The above table shows that VVC was present in 23 antenatal patients (11.5%) and UTI was present in 32 patients (16%). About 4 patients (17.4%) with VVC (out of 23) had associated UTI. However, the association between VVC and UTI was statistically not significant (p>0.05).

Table 5: Diagnosis Of Bacterial Vaginosis By Comparison between Amsel's Criteria and Nugent's Scoring

Methods of Diagnosis		Diagnosis of Bv by Nugents Scoring			P-Value
		Score >7 Bv Present (N=42)	Score 0-6 Bv Absent (N=158)	Total (N=200)	
AMSEL'S CRITERIA	BV PRESENT	28	7	35	p<0.05
	BV ABSENT	14	151	165	

In comparison with gold standard Nugent's criteria, the sensitivity, specificity, positive predictive value and negative predictive value of Amsel's criteria were 80%, 91.5%, 66.7% and 95.6% respectively. Statistical analysis showed that both methods could be used as a means for diagnosis of Bacterial vaginosis (p <0.05).

Table 6: Bacterial Isolates Detected From Hvs and Urine Culture

Isolates from Hvs	Total	Isolates from Urine	Total
E.coli	13	E.coli	10
K.pneumoniae	7	K.pneumoniae	4
K.oxytoca	7	K.oxytoca	3
P.mirabilis	3	P.mirabilis	3
P.vulgaris	0	P.aeruginosa	2
S.aureus	7	S.aureus	3
S.epidermidis	2	E.faecalis	1
S.agalactiae	1	A.baumannii	1
TOTAL	40	TOTAL	27

The predominant bacteria isolated from both HVS and urine was *E.coli*. Of the isolated bacteria from HVS 28.5% of *S.aureus* was found to be Methicillin-resistant *Staphylococcus aureus* (MRSA) ,69.2% of *E.coli* , 28.5% of *K.pneumoniae* and *K.oxytoca* were Extended-Spectrum β Lactamase (ESBL) isolates. Also among urinary isolates 30% of *E.coli*, 66.6% *K.oxytoca* were found to be ESBL.

Among the urinary isolates *E.coli* was found to be 70% resistant to Cefotaxime, 20% resistant to Cefotaxime clavulanate. *K.pneumoniae* was 75% resistant to Cefotaxime, 25% resistant to Cefotaxime clavulanate. and *K.oxytoca* was 67 % resistant to Cefotaxime, 66.6% resistant to Cefotaxime clavulanate. *E.coli, K.pneumoniae* and *E.faecalis* were 100% susceptible to Tetracycline (100%). *E.coli* and *K.pneumoniae* were 100% sensitive to Imipenem. *P.mirabilis* was 100% sensitive to Piperacillin tazobactum ,Cefotaxime, Cotrimoxazole, Gentamicin and Norfloxacin. *P.aeruginosa* was 100% sensitive to gentamicin, Ceftazidime and Piperacillin tazobactum. *A.baumannii* was MDR but 100% sensitive to Piperacillin tazobactum.

Among the vaginal isolates *E.coli* was found to be 64% resistant to Cefotaxime,14% resistant to Cefotaxime clavulanate. *K.pneumoniae* was 43% resistant to Cefotaxime, 14% resistant to Cefotaxime clavulanate. *K.oxytoca* was 57 % resistant to Cefotaxime, 29% resistant to Cefotaxime clavulanate. *E.coli, Klebsiella* species and *S.epidermidis* were 100% sensitive to Tetracycline. *E.coli* and *Klebsiella* species were also 100% sensitive to Imipenem. *P. mirabilis* was 100% sensitive to Piperacillin tazobactum, Ciprofloxacin, Cefotaxime, Amikacin and Gentamicin. *S.aureus* was highly susceptible to Chloramphenicol (100%) and Linezolid (100%) and least sensitive to Penicillin. Two MRSA isolates were sensitive to Vancomycin. *S.agalactiae* was 100% sensitive to Erythromycin, Cefotaxime, Chloramphenicol and Vancomycin.

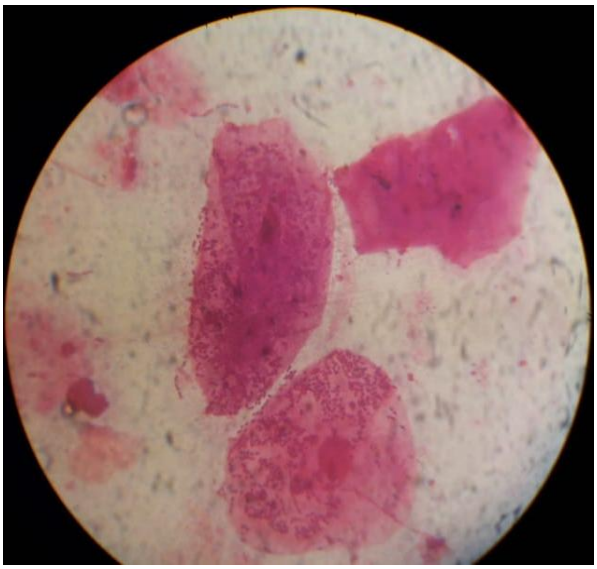
Table 7: Candida Species Isolated from Hvs and Urine

Candida Species	No. of Isolates in Hvs N =23	No. of Isolates in Urine N =5
C.albicans	14(60.9%)	4(80%)
C.glabrata	3(13%)	-
C.tropicalis	3(13%)	1(20%)
C.krusei	1(4.3%)	-
C.parapsilosis	2(8.6%)	-

Candida albicans (60.9%) was the commonest species isolated from HVS in this study. Of the non-albicans species isolated *C.glabrata* (13%) and *C.tropicalis* (13%) were the most common. Candida albicans isolates from HVS were 100% sensitive to Fluconazole, Itraconazole and least sensitive to Nystatin B. Among Candida non albicans species *C.tropicalis* and *C.parapsilosis* isolates were 100% sensitive to Fluconazole, Itraconazole, Voriconazole and Nystatin B. *C.glabrata* was only 33% sensitive to Fluconazole and Itraconazole. *C.krusei* is inherently resistant to azoles so tested only with Nystatin B and was found to be sensitive.

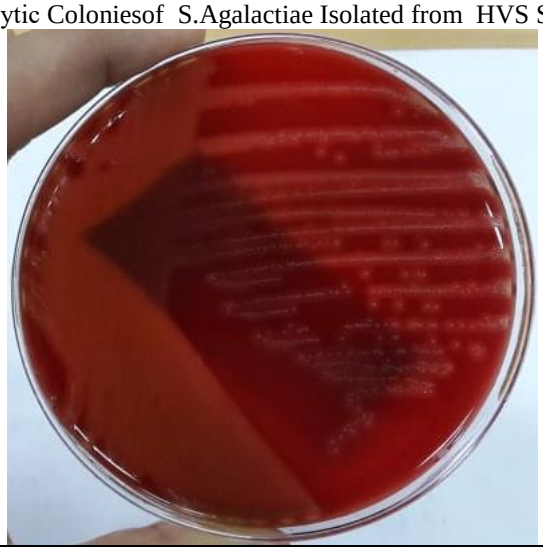
Among the urine isolates *Candida albicans* (80%) was the commonest species isolated followed by *C.tropicalis* (20%). Both isolates were 100% sensitive to Fluconazole, Itraconazole, Voriconazole and Nystatin B.

1. Direct Gram Stain from HVS Showing Clue Cells



2. S.Agalactiae Showing Positive CAMP Test

3. BAP Showing Bhemolytic Coloniesof S.Agalactiae Isolated from HVS Sample



DISCUSSION

This study was conducted among antenatal patients attending Obstetrics and Gynaecology department, irrespective of gestational age. A total of 200 patients meeting the inclusion criteria were enrolled. The overall prevalence of infectious vaginitis was found to be 32.5%, which is comparable to findings from Lamichhane et al [15] in Nepal reporting prevalence of 40%. Similar findings were also reported by Enwuru et al [16], who observed a high prevalence of bacterial vaginosis among pregnant women in Nigeria, emphasizing its continued burden in developing countries.

Vaginitis was most commonly observed in the 26–30 years age group (43.1%), followed by 21–25 years (40%), likely reflecting increased sexual activity in reproductive age groups. Similar trends were reported by Dipak Bhargava et al [17], though no statistically significant association between age and vaginitis was identified ($p > 0.05$).

The present study demonstrated a higher frequency of infection during the second trimester of pregnancy. Similar observations have been reported in recent literature, although some studies have documented increased prevalence during the third trimester because of hormonal and immunological changes occurring later in pregnancy [18]. Nevertheless, gestational age did not show a statistically significant association with infection in the present study.

Among the various infections identified, bacterial vaginosis (21%) was the predominant condition followed by vulvovaginal candidiasis (11.5%). Recent systematic reviews continue to identify bacterial vaginosis as the most common vaginal infection among pregnant women and an important risk factor for adverse pregnancy outcomes such as preterm labor, premature rupture of membranes, and low birth weight [19].

Diagnosis of bacterial vaginosis in this study was based on Amsel's criteria and Nugent scoring. Although molecular methods such as polymerase chain reaction offer improved sensitivity, they are expensive and less feasible in resource-limited settings. Therefore, conventional diagnostic methods continue to remain practical, economical, and reliable in routine clinical laboratories. In the present study, Nugent scoring detected a higher number of bacterial vaginosis cases (21%) compared to Amsel's criteria (17.5%), suggesting superior sensitivity. Statistical analysis showed that both methods could be used as a means for the diagnosis of bacterial vaginosis ($p<0.05$). Study by Rajeshwar Rao et al [21] in Hyderabad and Nawani et al [22] showed similar findings to our results.

The most common presenting symptom was vaginal discharge (77.5%), consistent with previous studies. Additional findings included elevated vaginal pH (>4.5) in 66% of patients, positive amine test in 35%, and presence of clue cells in 23%. Significant associations were observed between BV and symptoms such as foul-smelling discharge, lower abdominal pain, and burning micturition ($p < 0.05$).

In this study the prevalence of *Trichomonas vaginalis* was 0%. Similarly study done on prevalence of TV among pregnant women attending Irrua Specialist Teaching Hospital, Nigeria by Ochei Kingsley Chinedum et al [23] showed 0% prevalence and study by Lata et al [20] in Lucknow also reported 0% prevalence of TV.

The prevalence of UTI was 16%, with the highest incidence in the third trimester (50%), which was statistically significant ($p < 0.05$). This finding is comparable to studies by Bandyopadhyay et al [25] and Sabharwal [26] which reported prevalence of UTI as 25.2% and 24%, respectively. Study by Kant, et al [27] in rural Haryana also reported that the proportion of pregnant women with UTI was maximum in the third trimester similar to our study. This supports the recommendation that, if only one screening is feasible, it should ideally be performed during the third trimester.

BV associated with UTI was seen in 35.7% of the patients. The association between BV and UTI was found to be statistically significant ($p<0.05$). Previous similar study done by Lata et al [20] in Lucknow showed that about 14 patients with BV(out of 41) had associated UTI.. Also studies by Hillerbrand et al [28] have also reported pregnant women with bacterial vaginosis have a significantly increased risk of UTI. This relationship may be attributed to disruption of vaginal flora, particularly reduced lactobacilli, leading to increased vaginal pH and colonization by uropathogens [28]. Sexual activity and hygiene factors may further influence this association. In contrast, the association between VVC and UTI was not statistically significant ($p > 0.05$), although other studies have reported differing results.

In our study among vaginal isolates 28.5% of *S.aureus* were found to be MRSA and 69% of *E.coli* were ESBL. This which was much similar when compared to study done by Lamichhane et al [15] in Nepal. *Streptococcus agalactiae* (Group B Streptococci β haemolytic, GBS) constitutes about 2.5% of total vaginal isolates in our study. The isolate showed 100% susceptibility to Cefotaxime, Erythromycin, Chloramphenicol and Vancomycin. However, study by Lamichhane et al [15] reported higher prevalence of 8.6%. GBS infection is an important cause of neonatal morbidity and mortality.

Table 6 shows the uropathogens isolated in our study which includes *E.coli*, *Klebsiella spp*, *Proteus spp*, *A.baumannii*, *S.aureus* and *E.faecalis*. About 33% of the urinary isolates were found to be MDR. Lamichhane et al [15] reported similar profile of uropathogens with 56% MDR

isolates. The higher rate of MDR among uropathogens may be because of repeated and irrational use of antibiotics which is especially true for developing countries where antibiotics are irrationally prescribed not only by the medical practitioners, but the antibiotics are also purchased directly from the pharmacist without any prescription [15]. Therefore, the empirical treatment of UTIs has become more difficult and choice of antibiotics should be based on urine culture and antimicrobial susceptibility testing.

Candida albicans was the commonest species among candida isolated from HVS (60.9%) and Urine (80%). *C.tropicalis* was the only Candida non albicans species isolated from (20%) urine specimen and it was also found in (13%) HVS. *C.glabrata* (13%), *C.parapsilosis* (8.6%) and *C.krusei* (4.3%) were the candida species isolated from HVS. Study by Gandhi et al [30] in Gujarat showed similar finding of C.albicans 66 %, C.glabrata 15%, C.krusei 3%, *C.parapsilosis* 5% and *C.tropicalis* 9.8% isolated from HVS.

Antifungal susceptibility pattern of candida isolates from HVS showed that Candida albicans isolates were 100% sensitive to Fluconazole, Itraconazole and least sensitive to Nystatin B (86%). Among Candida non albicans species *C.tropicalis* and *C.parapsilosis* isolates were 100% sensitive to all azoles tested and Nystatin B. *C.glabrata* was only 33% sensitive to Fluconazole, Itraconazole and *C. krusei* was 100% sensitive only to Nystatin B as it is inherently resistant to azoles. These findings were in accordance with the study conducted by Mondol S et al [30] which showed 82% of total Candida isolates were sensitive to Fluconazole by disc diffusion with highest rate of resistance among *C.krusei* (60%) followed by *C.glabrata* (30%).

The resistance to fluconazole is of great concern because it is the azole which is most commonly used for superficial candidal infections as well as deep candidiasis. Since majority of the isolates from HVS and urine were *C.albicans* which were almost 100% susceptible to Fluconazole its use may be continued for empirical therapy of uncomplicated candidal vulvo-vaginitis and UTI. However, timely monitoring of drug susceptibility must be done to detect the emerging resistance.

CONCLUSION

The present study demonstrated a high prevalence of vaginitis among antenatal patients. Bacterial vaginosis was the most prevalent type of vaginitis among pregnant women, which can contribute to adverse outcomes in pregnancy such as abortion, premature rupture of membrane and preterm labor [19]. Screening for BV among pregnant women at regular intervals or when symptomatic, and early treatment can not only reduce the adverse outcomes but also decrease maternal and perinatal morbidity and mortality. Therefore, it is recommended that antenatal healthcare facilities should incorporate screening of vaginitis among pregnant women, and those with BV should also be screened for UTI [28]. Since douching, smoking and multiple sexual partners are risk factors for BV [19], preventive measures against these factors should also be undertaken.

Increasing prevalence of MDR pathogens among urinary isolates (33%) makes the empirical treatment of UTIs more difficult and choice of antibiotics should be based on urine culture and antimicrobial susceptibility testing. Thus, proper and judicious use of antibiotics must also be encouraged.

Further large scale studies are required to establish the association of UTI and infectious vaginitis in both pregnant and non- pregnant women in order to identify the causative agents and enable prompt treatment to prevent pregnancy- associated complications among women of reproductive age.

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