Etiological Characterization of Infectious Vaginitis among Reproductive-Aged Women Visiting a Tertiary Care Center in Nepal

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ABSTRACT

Objectives: To characterize the etiology of infectious vaginitis among reproductive-aged women visiting a tertiary care hospital in Nepal.

Methods: The vaginal samples were collected from woman with abnormal vaginal discharge. Nugent's score system and Amsel's criteria were used in diagnosing bacterial vaginosis (BV), wet mount preparation was done to diagnose trichomonal vaginitis (TV), and Aerobic vaginitis (AV), and vulvovaginal candidiasis (VVC) were diagnosed by culture method. Clinical and Laboratory Standards Institute (CLSI) guidelines were used to assess the antimicrobial susceptibility profile of aerobic bacteria and *Candida* isolates.

Results: Out of 141 reproductive-aged women included, 60.3% presented with thin and scanty vaginal discharge, 52.5% had clear to white discharge, and 39.0% had vulvovaginal itching. The overall rate of any type of infectious vaginitis was 44.0% with the predominance of BV (19.8%) followed by AV (12.8%), VVC (11.3%), and TV (7.1%). Infectious vaginitis was frequent among women between the age of 25 and 34 years. BV was significantly associated with malodorous discharge (p = 0.002) and VVC was significantly higher in women with vulvovaginal itching (p = 0.009). The most common aerobic bacteria that caused AV was *Escherichia coli*, while *Candida albicans* represented the most common cause of VVC.

Conclusion: Incorporating simple laboratory test in management of vaginal discharge cases helps identify correct etiology minimizing the disease burden with appropriate use of antibiotics.

Keywords: Bacterial vaginosis, aerobic vaginitis, trichomonal vaginitis, candidiasis, Nepal.

INTRODUCTION

Vaginitis is a clinical condition with inflammation of the vagina that may occur due to microbial infections as well as non-infectious factors such as allergies, chemical irritation, and decrease in estrogen (Egan et al. 2000). In a healthy vaginal tract of reproductive-aged women, the lactobacilli group of normal flora competes with pathogen-

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ic bacteria when present in abundant numbers (Lakshmi et al. 2013 and Abdul-Aziz et al. 2019). Bacterial vaginosis (BV), vulvovaginal candidiasis (VVC), and trichomonal vaginitis (TV) are three major causes of infectious vaginitis (Abdul et al. 2019). Infectious vaginitis is the major reproductive tract infection (RTI) in sexually active women and is characterized by abnormal and excessive vaginal discharge, irritation, malodor, vulvar itching, and dysuria (Truter & Graz, 2013).

BV occurs as a result of the replacement of dominated normal lactobacilli flora with a complex flora of *Gardnerella vaginalis*, *Mycoplasma hominis*, *Mobiluncus* species, *Bacteroides* species, and some other anaerobic bacteria (Truter & Graz, 2013 and Bhargava et al. 2016). Aerobic vaginitis (AV), distinct from BV occurs when the vaginal lactobacilli flora are replaced predominantly by aerobic commensals or pathogenic bacteria such as Group B Streptococci (GBS), *Staphylococcus aureus, Escherichia coli, Enterococcus* spp., and *Listeria monocytogenes* (Lakshmi et al. 2013 and Donders et al. 2011). Vaginal colonization with *Candida* species has been ascribed to several factors, including pregnancy, poor personal hygiene, and continuous use of broad-spectrum antibiotics (Bitew et al. 2018 and Konadu et al. 2019). Although VVC is most commonly produced by *Candida albicans*, the frequency is increasing due to non-albicans *Candida* (NAC) species such as *C. tropicalis, C. glabrata,* and *C. krusei* (Bitew et al. 2018). TV is the most prevalent non-viral sexually transmitted infection (STI) globally caused by the protozoan parasite *Trichomonas vaginalis*. In resource-limited countries and among underprivileged populations in developed countries, a higher prevalence of trichomoniasis has been reported (Asmah et al. 2017 and Asmah et al. 2018).

Vaginitis can affect any ethnicity or race of the population and the prevalence of BV is 5% to 15% in African Caucasian women and 45% to 55% in American blacks. Among Asian women, the prevalence is 20% to 30% (Sobel et al. 2003). Among infectious vaginitis in symptomatic women, BV accounts for 40% to 50% of cases, VVC accounts for 20% to 25%, and trichomoniasis accounts for 15% to 20% of cases (Paladine et al. 2018). About 75% of reproductive-aged women experience VVC at least once, and nearly half experiences a recurrent infection, having 5% to 8% with multiple episodes each year (Gandhi et al. 2015). In the context of Nepal, the rate of infectious vaginitis was 46.96% in 2016 with the highest incidence among sexually active women [5].

Many infectious vaginitis cases are asymptomatic and even non-specific in symptomatic cases that can lead to complications like pelvic inflammatory disease (PID), infertility, and ectopic pregnancy, which necessitates the timely detection of causative agents (Fredricks et al. 2005). Even though establishing an etiological diagnosis is a prerequisite for effective treatment, the management of infectious vaginitis is still largely empirically based on clinical presentation (Narayankhedkar et al. 2015). This leads to the widespread use of antimicrobial agents even in patients with no specific etiological cause. Therefore, if we could incorporate laboratory tests for the diagnosis of vaginitis cases, it will help to distinguish between the non-infectious type or mixed or single infections with direct evidence of causative agents, thus ensuring justified administration of antimicrobial agents. Hence, this study was conducted to explore the etiology of infectious vaginitis and to determine their antimicrobial susceptibility profile among reproductive-aged women visiting a tertiary care hospital in Nepal.

METHODS

Study design, study site and study population

This study was conducted from October 2016 to September 2017 in the gynecology and clinical microbiology department of Tribhuvan University Teaching Hospital (TUTH), Nepal. During the study period, all reproductive-aged women, 15 to 49 years of age, visiting the gynecology outpatient department with a history of abnormal per vaginal (PV) discharge were included in the study. Women who were pregnant, menstruating, having bleeding per vagina, with known genital tract malignancies, and who had received antimicrobial treatment in the preceding week during enrollment in the study were excluded.

Sample collection, transport and processing

A gynecologist examined the vagina of each woman for the characteristics of vaginal discharge (color, consistency, and odor). Then, the vaginal samples were collected from the posterior fornix with two sterile cotton-tipped swabs. The vaginal swabs were then placed into separate tubes containing approximately 2 ml of sterile normal saline and transported immediately to the microbiology laboratory (Bhargava et al. 2016). One vaginal swab was used for Gram's staining and wet mount preparation for microscopic examination. The second swab was used for the isolation of aerobic bacteria and *Candida* species.

Laboratory procedure of clinical sample

Diagnosis of Bacterial Vaginosis (BV)

For the diagnosis of BV, Nugent's scoring system and Amsel's criteria were used. Gram's staining was performed to determine Nugent's score. Nugent's score system was based on the number of different morphotypes of bacteria, viz. *Lactobacillus*-like (large uniform Gram-positive rods), *Gardnerella vaginalis*-like (small pleomorphic Gram-varia-

ble rods), or *Prevotella*/*Bacteroides*-like (small Gram-negative rods), and *Mobiluncus*-like (curved Gram-variable rods) (Nugent et al. 1991). Based on Amsel's criteria, BV was confirmed if at least three of the following four criteria were fulfilled; grayish-white, thin, and homogeneous vaginal discharge, vaginal pH higher than 4.5, fishy or amine odor after addition of 10% KOH, or presence of clue cell (>20%) in a microscopic examination (Amsel et al. 1983).

Diagnosis of Trichomonal Vaginitis (TV)

Direct wet mount preparation was carried out for the microscopic examination of *T. vaginalis.* A drop of vaginal secretion in normal saline was placed on a clean grease-free glass slide and examined under a light microscope (X40 objective) for the characteristic morphology and jerky motility of *T. vaginalis (*Kadir et al. 2014).

Diagnosis of Aerobic Vaginitis (AV)

For the diagnosis of AV, the specimens were inoculated on a chocolate agar plate, 5% sheep blood agar plate, and MacConkey agar plate and incubated at 37^0C for 24-48 hours in an aerobic atmosphere using standard procedures recommended by the American Society for Microbiology (ASM). Identification of bacterial isolates was done by observation of colony characteristics, Gram's staining, motility testing, and different biochemical tests (Isenberg, 2007).

Diagnosis of Vulvovaginal Candidiasis (VVC)

For the diagnosis of VVC, the swabs were also inoculated on two tubes of Sabouraud's dextrose agar, one was incubated at 25^0C and another tube at 37^0C for 48 hours. After growth, *Candida* isolates were identified by culture characteristics, Gram's stain, germ tube test, and development of distinct types and color of colonies on HiChrome Candida differential agar as per the manufacturer's instructions Esmaeilzadeh et al. (2009) and (HiMedia. HiCrome™ Candida Differential Agar).

Antibiotic Susceptibility Test

The Kirby-Bauer disk diffusion method was used to evaluate and interpret the antibiotic susceptibility profile of aerobic bacterial isolates following the guideline given by the Clinical and Laboratory Standards Institute (CLSI), M100S Document, 26th Edition (2016). The bacterial isolates were tested against a specified concentration of recommended antibiotics as applicable (CLSI, 2016).

Antifungal Susceptibility Test

Candida species were tested for antifungal susceptibility using the disk diffusion method on Mueller Hinton Agar (MHA) (Himedia, India) supplemented with 2% (w/v) glucose and 0.5 g/ml methylene blue dye. The *Candida* isolates were tested against amphotericin B (20 µg), nystatin (50 µg), fluconazole (10 µg), itraconazole (10 µg), and ketoconazole (50 µg) (Himedia, India) as per the guidelines of the CLSI (M44-A2 Document) (CLSI, 2009) and (Mahmoudabadi et al. 2012).

Statistical Analysis

The data were analyzed using were analyzed using IBM SPSS version 20.0 (IBM Corp., Armonk, NY, USA). The graphs were prepared using Microsoft Excel 2013. Frequency distribution and percentages were used to present the data. Continuous variables were interpreted as median while categorical variables were reported in numbers and percentages. The association between variables was tested using Pearson's chi-square test and *P-values* <0.05 were considered statistically significant.

Ethics statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board of the Institute of Medicine, Tribhuvan University, Nepal [265(6-11-E)2/073/074; January 27, 2017].

RESULTS

During the study period, a total of 141 reproductive-aged women visited the gynecology outpatient department of TUTH with a history of abnormal PV discharge. The women age ranged from 17 to 49 years with a median age of 28.0 years. The majority of women were within the age group 25-34 years (49.6%). Among the total cases, maximum women presented with thin and scanty vaginal discharge (60.3%) followed by clear to white discharge (52.5%), vulvovaginal itching (39.0%), abdominal pain (36.9%), malodor (36.2%), and 23.4% had dysuria (Table 1)

The overall prevalence of any type of infectious vaginitis among reproductive-aged women was 44.0% with the predominance of BV (19.8%) followed by AV (12.8%), VVC (11.3%), and TV (7.1%). A single type of infection was seen in 36.9% of reproductive-aged women while multiple infections were seen in 7.1%. 56.0% of women were found without any infection (Table 2).

Infectious vaginitis was frequent among women of age between 25 and 34 years (41.9%). BV and VVC were commonly seen in women between 25 and 34 years of age, while AV was common among all age groups and TV was commonly seen in women between 15 and 24 years of age (Figure 1).

Table 1: Demographic and clinical characteristics of reproductive-aged women attending gynecology outpatient department of TUTH, Nepal (n=141)

Characteristics	Frequency	Percentage
Age (years)		
15-24	39	27.7
25-34	70	49.6
35-44	22	15.6
44-49	10	7.1
Color of discharge		
Clear to white	74	52.5
White curdy	46	32.6
Yellowish/greenish	21	14.9
Consistency of discharge		
Thin and scanty	85	60.3
Thick and profuse	56	39.7
Malodour		
Present	51	36.2
Absent	90	63.8
Vulvovaginal itching		
Present	55	39.0
Absent	86	61.0
Abdominal pain		
Present	52	36.9
Absent	89	63.1
Dysuria		
Present	33	23.4
Absent	108	76.6

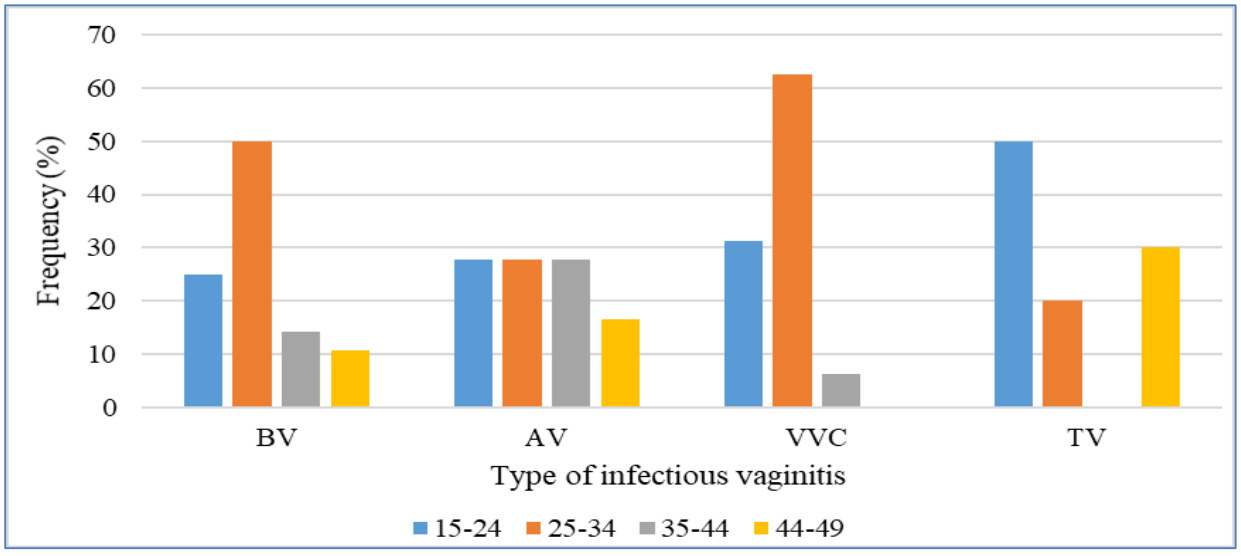

Figure 1: Type of infectious vaginitis among the different age groups of reproductive-aged women. (N=62). AV = Aerobic vaginitis; BV = Bacterial vaginosis; VVC = Vulvovaginal candidiasis; TV = Trichomonal vaginitis

Table 2: Prevalence of infectious vaginitis among reproductive-aged women (n=141*).*

Type of infectious vaginitis	Frequency of infected women	Percentage (%)
Overall prevalence (combined)	***62***	***44.0***
BV	28	19.8
AV	18	12.8
VVC	16	11.3
TV	10	7.1
Single infection (any type)	***52***	***36.9***
BV	18	12.8
AV	13	9.2
VVC	13	9.2
TV	8	5.7
Multiple infection (any type)	***10***	***7.1***
BV+AV	5	3.6
BV+VVC	3	2.1
BV+TV	2	1.4
No infection	***79***	***56.0***

AV = aerobic vaginitis; BV = bacterial vaginosis; VVC = vulvovaginal candidiasis; TV = trichomonal vaginitis

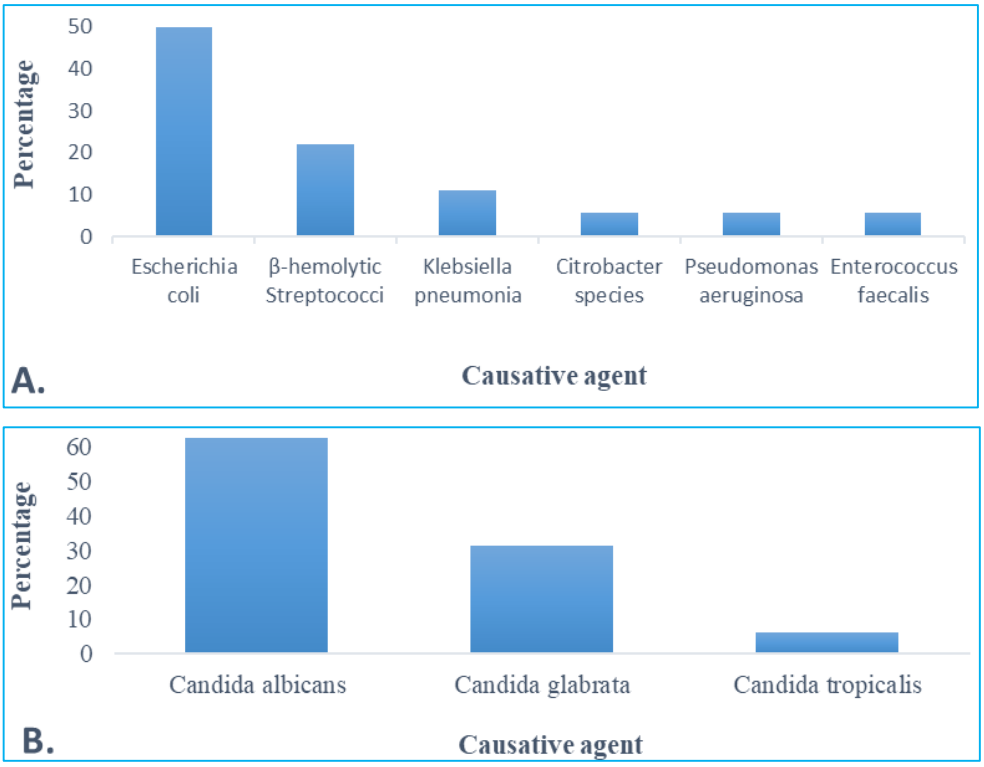

Figure 2: Distribution of etiology. A. Aerobic vaginitis *(n= 18)* **and B. Vulvovaginal candidiasis** *(n= 16).*

Table 3 shows the association between different types of infectious vaginitis and clinical features among reproductive-aged women. For comparison between clinical presentation and type of infectious vaginitis, we used chi-square test at 5% level of significance.

BV was significantly higher among women with malodorous discharge (60.7%, *P* = 0.002), AV was higher in women with yellowish or greenish vaginal discharge (50.0%, *P* = 0.001) and VVC was significantly higher in women with vulvovaginal itching (68.7%, *P* = 0.009).

TV was significantly associated with thick and profuse consistency of vaginal discharge (*P* = 0.043), malodor (*P* = 0.021), and vulvovaginal itching (*P* = 0.037).

The distribution of etiology of AV and VVC is shown in Figure 2.

E. coli was isolated from 50.0% of cases of AV, and β-hemolytic Streptococci was the second common agent of AV (22.1%). *C. albicans* represented the major agent (62.5%) of VVC, followed by *C. glabrata* (31.3%) and *C. tropicalis* (6.2%).

The antibiotic susceptibility profile of bacterial isolates that cause AV is shown in Table 4. Amoxicillin-clavulanic acid, ciprofloxacin, gentamicin, and cotrimoxazole were found to be more effective against *E. coli* isolates.

Table 5 shows the antifungal susceptibility profile of *Candida* isolates. *C. albicans* isolates were more susceptible to nystatin (100%) and amphotericin B (80.0%), but less susceptible to itraconazole (40.0%), ketoconzole (40.0%), and fluconazole (30.0%).

Table 3: Association of different infectious vaginitis with clinical fitures among reproductive-aged women attending gynecology outpatient department of TUTH, Nepal

Clinical characteristics	BV		AV		VVC		TV	
	n (%)	*P*-value	n (%)	*P*-value	n (%)	*P*-value	n (%)	*p*-value
Color of discharge								
Clear to white	17 (60.7)	0.880	6 (33.3)	0.001*	8 (50.0)	0.473	6 (60.0)	0.433
White curdy	4 (14.3)		3 (16.7)		8 (50.0)		0 (0)	
Yellowish/greenish	7 (25.0)		9 (50.0)		0 (0)		4 (40.0)	
Consistency of discharge								
Thin and scanty	20 (71.4)	0.181	11 (61.1)	0.939	11 (68.7)	0.466	3 (30.0)	0.043*
Thick and profuse	8 (28.6)		7 (38.9)		5 (31.3)		7 (70.0)	
Malodor								
Present	17 (60.7)	0.002*	6 (33.3)	0.790	4 (25.0)	0.327	7 (70.0)	0.021*
Absent	11 (39.3)		12 (66.7)		12 (75.0)		3 (30.0)	
Vulvovaginal itiching								
Present	11 (39.3)	0.973	5 (27.8)	0.299	11 (68.7)	0.009*	7 (70.0)	0.037*
Absent	17 (60.7)		13 (72.2)		5 (31.3)		3 (30.0)	
Abdominal pain								
Present	13 (46.4)	0.245	8 (44.4)	0.480	5 (31.3)	0.623	4 (40.0)	0.833
Absent	15 (53.6)		10 (55.6)		11 (68.7)		6 (60.0)	
Dysuria								
Present	10 (35.7)	0.087	6 (33.3)	0.290	2 (12.5)	0.277	1 (10.0)	0.302
Absent	18 (64.3)		12 (66.7)		14 (87.5)		9 (90.0)	

AV = Aerobic vaginitis; BV = Bacterial vaginosis; VVC = Vulvovaginal candidiasis; TV = Trichomonal vaginitis; n = number of women positive for BV or AV or VVC or TV; P < 0.05 was considered statistically significant.

Table 4: Antibiotic susceptibility profile of bacterial isolates causing aerobic vaginitis

Antibiotics	Frequency (n) and percentage (%) of antibiotic susceptible isolates					
	***E. coli* (n=9)**	***β-hemolytic Streptococci* (n=4)**	***K. pneumoniae* (n=2)**	***Citrobacter* spp. (n=1)**	***P. aeruginosa* (n=1)**	***E. faecalis* (n=1)**
Ampicillin	3 (33.3)	4 (100)	NT	NT	NT	1 (100)
Amoxycillin-clavulanic acid	8 (88.9)	NT	1 (50.0)	NT	NT	NT
Cefotaxime	3 (33.3)	3 (75.0)	0 (0)	0 (0)	NT	NT
Ceftazidime	NT	NT	NT	NT	1 (100)	NT
Ciprofloxacin	8 (88.9)	4 (100)	0 (0)	1 (100)	0 (0)	1 (100)
Gentamicin	7 (77.8)	NT	1 (50.0)	1 (100)	0 (0)	1 (100)¶
Cotrimoxazole	8 (88.9)	NT	2 (100)	1 (100)	NT	NT
Piperacillin	NT	NT	NT	NT	1 (100)	NT
Piperacillin-tazobactam	NT	NT	NT	NT	1 (100)	NT
Vancomycin	NT	4 (100)	NT	NT	NT	1 (100)
Teicoplanin	NT	NT	NT	NT	NT	1 (100)

NT = antibiotics either not tested or not recommended by CLSI; ¶high-level gentamicin

Table 5: Antifungal susceptibility profile of *Candida* species causing vulvovaginal candidiasis

Antifungal agents		***C. albicans* (n=10)**	***C. glabrata* (n=5)**	***C. tropicalis* (n=1)**
Nystatin	S	10 (100)	5 (100)	1 (100)
	SDD	0 (0)	0 (0)	0 (0)
	R	0 (0)	0 (0)	0 (0)
Amphotericin B	S	8 (80.0)	5 (100)	1 (100)
	SDD	0 (0)	0 (0)	0 (0)
	R	2 (20.0)	0 (0)	0 (0)
Itraconazole	S	4 (40.0)	5 (100)	0 (0)
	SDD	0 (0)	0 (0)	0 (0)
	R	6 (60.0)	0 (0)	1 (100)
Ketoconazole	S	4 (40.0)	5 (100)	1 (100)
	SDD	0 (0)	0 (0)	0 (0)
	R	6 (60.0)	0 (0)	0 (0)
Fluconazole	S	3 (30.0)	4 (80.0)	0 (0)
	SDD	0 (0)	0 (0)	0 (0)
	R	7 (70.0)	1 (20.0)	1 (100)

S = susceptible; SDD = susceptible dose-dependent; R = resistant

DISCUSSION

The etiologies of infectious vaginitis are numerous, and precise identification of etiological agent(s) aids in proper management, effective care, and prevention of infectious vaginitis complications (Kiran et al. 2017). Here we found 44.0% of reproductive-aged women with abnormal vaginal discharge have one or more forms of infectious vaginitis caused by BV, AV, VVC, or TV. This rate is comparable to those reported by Mathew et al. (2011) from India (44.0%), Bhargava et al. (2016) from Nepal (47.0%), and Abdul-Aziz et al. (2019) from Yemen (37.6%). On the other hand, Masand et al. (2015) from India reported exceptionally higher rates of vaginitis (89.0%) among reproductive-aged women but Mulu et al. (2015) from Ethiopia reported a lower prevalence of 15.4%. This variation in vaginal infection rates may be explained by differences in the approaches used to isolate and identify the causes of vaginal infections. Differences in socioeconomic and cultural factors, study participants' hygiene habits, and environmental factors may also explain the gap (Masand et al. 2015 and Mulu et al. 2015).

In the present study, BV was found to be more prevalent in 19.8% of reproductive-aged women than AV (12.8%) and VVC (11.3%), and TV was the least common cause of vaginitis reported in 7.1% of women. Our report on the rate of BV is consistent with the observations of Brooks-Smith-Lowe et al. (2013) from West Indies (19.5%) and Mascarenhas et al. (2012) from Brazil (20.0%). However, our finding is slightly lower than those reported by Bhargava et al. (2016) from Nepal (24.5%, 81/330), and Kiran et al. (2017) from India (22.6%). Besides this, a lower BV prevalence of 16.2% was reported among non-pregnant women in Iran (Bahram et al. 2009). AV can be misdiagnosed as BV, resulting in inadequate treatment (Kaambo et al. 2018). The exact prevalence of AV is still unclear. In the present study, the rate of AV (12.8%) is lower than those reported by Sangeetha et al. (20.8%) and Nahar et al. (26.0%) from India (Sangeetha et al. 2014 and Nahar et al. 2016). Our result on VVC rate (11.3%) is also similar to those reported by Lamichhane et al. (2014) from Nepal (11.3%, 28/230), and Oliveira et al. (2007) from Brazil (12.5%). The prevalence of TV (7.1%) is comparable to the observations of Bahram et al. (2009) from Iran (6.6%) and (Madhivanan et al. 2009) from India (8.5%). The greater number of BV cases over the other causes of infectious vaginitis has been also reported by Bhargava et al. (2016) and Shrestha et al. (2011) from Nepal, Abdul-Aziz et al. (2019) and (Masand et al. 2015) from India, and (Olowe et al. 2014) from Nigeria.

In our study, a single type of infection was seen in 36.9% while multiple infections were seen in 7.1% of reproductive-aged women. Multiple infections of BV+AV were observed in 3.6%, BV+VVC in 2.1%, and BV+TV in 1.4% of reproductive-aged women. (Bhargava et al. 2016) from Nepal also reported 38.8% (128/330) single infection and 8.2% (27/330) mixed infections of vaginitis among total reproductive-aged women (Abdul-Aziz et al. 2019) from Yemen reported 34.6% (120/347) single infection and only 2.9% (10/347) multiple infections of vaginitis where mixed infections with BV and VVC were observed in 2.6% (9/347) of reproductive-aged women. Women with BV are likely to lose their normal defenses against genital tract infections, resulting in the development of co-infections such as TV and VVC (Madhivanan et al. 2008).

This study represented that infectious vaginitis was most frequently diagnosed among 25 to 34 years women (41.9%). BV and VVC were also common in this age, while AV was found in all age groups and TV was commonly seen in women between 15 and 24 years of age. This finding agrees with the observations of many studies. In Nepal, (Shrestha et al. 2011, Bhargava et al. 2016, and Lamichhane et al. 2014) found a higher rate of infectious vaginitis in women of age 20 to 39 years, 20 to 29 years, and 20 to 29 years, respectively. Yusuf et al. (2011) from Bangladesh also found a higher prevalence of vaginitis, BV, and VVC in sexually active women aged 26 to 35 years. Zhang et al. (2020) from China also concluded that AV is common among all age groups and Yusuf et al. (2011) from Bangladesh documented that TV is more common among 15 to 25 years.

The characteristics of the vaginal discharge are variable, which depends upon the type of etiological agents of infectious vaginitis (Kiran et al. 2017). Yellowish or greenish vaginal discharge of clinical manifestation is associated with AV, which is statistically significant (P = 0.001). There is an association between thick and profuse consistency of vaginal discharge and TV, which is statistically significant (P = 0.043). Among the women with BV (n=28), 60.7% had malodor (P = 0.002) and among the

women with TV (n=10), 70.0% presented with malodorous discharge (P = 0.021). (Ranjit et al. 2018) from Nepal and Konadu et al. [8] from Ghana also reported a significant association between the odor of vaginal discharge and BV. Among the women with VVC (n=16), 68.7% presented with vulvovaginal itching, and 70% of the women with TV had vulvovaginal itching. A significant association between vulvovaginal itching and VVC (P = 0.009) and TV (P = 0.037) was noted. Abdul-Aziz et al. (2019) and Narayankhedkar et al. (2015) from India also noted a significant association between VVC and vulvovaginal itching and Asmah et al. (2018) from Ghana reported such association between TV and vulvovaginal itching.

In this analysis, *E. coli* was responsible for most of the cases of aerobic bacterial vaginitis (50.0%), followed by β-hemolytic Streptococci (22.2%) and *K. pneumoniae* (11.1%). *E. coli* was also identified as a major cause of AV by Mulu et al. (2015) from Ethiopia. The susceptibility of *E. coli* to amoxicillin-clavulanic acid and gentamicin was 88.9% and 77.8%, respectively, which is almost identical to the findings of Nahar et al. (2016). In this study, the majority of VVC was caused by *C. albicans* (62.5%) and the second common agent was *C. glabrata* (31.3%) followed by *C. tropicalis* (6.2%). *C. albicans* as a major cause of VVC was also documented by Bitew et al. (2018) from Ethiopia, and Waikhom et al. (2020) from Ghana. The susceptibility of *C. albicans, C. glabrata,* and *C. tropicalis* to nystatin was 100% in our study, which is similar to the result of (Liu et al. 2014) where 99.8% of *C. albicans* and *C. glabrata*, and 99.1% of *C. tropicalis* isolates were sensitive to nystatin.

Conclusion

According to the findings of this study, reproductive-aged women who visited a tertiary care hospital in Nepal had a significant burden of infectious vaginitis, with BV being the most common, followed by AV, VVC, and TV. Early treatment of infectious vaginitis based on proper identification of the causative agent rather than a blanket empirical approach would help in reducing unnecessary use of antimicrobial agents and thus reduce the burden of infectious vaginitis.

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CONFLICT OF INTEREST

The authors declared no conflict of interest.

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