STM JOURNALS

Recent Trends in
Infectious Diseases

Volume 1, Issue 2, 2024
July—December
DOI (Journals): 10.37591/RTID

https://journals.stmjournals.com/rtid

Research RTID

Lower Genital Tract Infections in Pregnant Women: Epidemiology and Risk Factors Associated in Dakar, Senegal

Ndeye Safietou Ngom[1,*], Gora Lo[2], Assane Dieng[2], Doudou Georges Massar Niang[4], Serigne Mbaye Lo Ndiaye[2], Alioune Tine[2], Awa ba-Diallo[2], Omar Gassama[3], Halimatou Diop-Ndiaye[2], Makhtar Camara[2]

Abstract

Vaginal infections are responsible for many problems in women of childbearing age and significantly influence pregnancy outcomes. This study sought to ascertain the prevalence of lower genital tract infections and the risk factors associated with them in pregnant women under observation at the Nabil Choucair Health Centre in Dakar, Senegal. The cross-sectional study lasted nine months from July 2020 to March 2021. Women aged 34 to 38 weeks of gestation (WG) were included.. The vaginal samples were analyzed using the humid montage method, Gram coloration (Nugent criteria), and culture in a specific medium. The data was analyzed using SPSS version 25 and the chi-two test to determine the strength of the association. A significance level of $p < 0.05$ was set for the statistical tests. Microbiological confirmation of infection was found in 227 pregnant women, resulting in an overall prevalence of 59.1% (227/384). In the series, the median gestational age was 36 WG. Only 55.9% (215/384) of patients reported infection-related symptoms. With 42.7% (164/384) of these infections being vulvovaginal candidiasis, it was the most frequent, followed by bacterial vaginosis (29.2%; 112/384) and Trichomonas vaginal (1.3%; 5/384). Mixed infections were recorded at 24.8% (n = 94), with a Gardnerella vaginalis/Candida spp. co-infection rate estimated at 13.80% (n = 53). Other germs found in mixed infections included Group B Streptococcus (GBS; 8.07%; n = 31) and Escherichia coli (0.78%; n = 3). Clinical symptoms (p = 0.018), bleeding from ectocervical contacts (p = 0.005), and unfavorable pregnancy outcomes (p = 0.020) were significantly correlated with the occurrence of lower genital tract infections. Our findings show a high prevalence of vaginal infections during pregnancy. Vaginal sampling during pregnancy should be included in the prenatal surveillance program to reduce the disease burden and complications associated with lower genital tract infections.

Keywords: Lower genital infections, Pregnant women, Associated risk factors, Senegal.

***Author for Correspondence**
Ndeye Safietou Ngom
E-mail: safietou11@hotmail.com

[1]Student, Bacteriology-Virology Laboratory, National University Hospital Center Aristide Le Dantec, Dakar, Senegal
[2]Professor, Bacteriology-Virology Laboratory, National University Hospital Center Aristide Le Dantec, Dakar, Senegal
[3]Professor, Gynecological and obstetrical clinic, National University Hospital Center Aristide Le Dantec, Dakar, Senegal
[4]Student, Immunology Unit, Faculty of Medicine, Pharmacy and Dentistry, Cheikh Anta Diop University, Dakar, Senegal

Received Date: February 08, 2024
Accepted Date: March 08, 2024
Published Date: May 01, 2024

Citation: Ndeye Safietou Ngom, Gora Lo, Assane Dieng, Doudou Georges Massar Niang, Serigne Mbaye Lo Ndiaye, Alioune Tine, Awa ba-Diallo, Omar Gassama, Halimatou Diop-Ndiaye, Makhtar Camara. Lower Genital Tract Infections in Pregnant Women: Epidemiology and Risk Factors Associated in Dakar, Senegal. Recent Trends in Infectious Diseases. 2024; 1(2): 47–59p.

INTRODUCTION

Lower genital tract infections (LGTIs) cause many health problems during pregnancy, particularly in underdeveloped countries [1]. They cause symptoms that are often neglected and poorly treated and can be complicated by pelvic inflammatory disease, cervicitis, chorioamnionitis and lead to premature labor, low birth weight, and miscarriage [2]. The World Health Organization (WHO) reports that infections are the direct cause of 15% of maternal deaths [3]. In Senegal, infections represent 26.3% of the etiologies of maternal deaths [4].

© STM Journals 2024. All Rights Reserved

The germs involved are mainly agents of Sexually Transmitted Infections (STI) such as *Trichomonas vaginalis* (TV), germs of the vaginal flora as *Candida albicans*, *Gardnerella vaginalis (GV) or Mobilluncus* spp. (Mob spp) or germs of the colonic flora as Group B *Streptococcus* (GBS) or *Escherichia coli* which behave like opportunistic pathogens. They must be sought in all pregnant women [5].

The frequency of isolation of each of these germs varies from country to country, especially with the means of investigation used [6]. Physical examination, self-reported symptoms, vaginal fluid pH, microscopy, and culture on a media are the traditional and clinical methods for diagnosis of vaginal diseases [7–9].

Faced with numerous difficulties such as the lack of specificity of symptoms; the frequency of asymptomatic infections and mixed infections, the WHO recommends management based on the syndromic approach, which limits epidemiological data on specific etiological agents. For all these reasons, In Senegal, little information is available on the extent of lower genital tract infections in pregnant women and their associated determinants. Contextually, this study sought to ascertain the frequency of various vaginal infections and related risk factors among patients visiting the maternity ward of the Nabil Choucair health center in Dakar.

METHODOLOGY

Procedure for Designing, Studying, and Sampling

The study was approved by the National Ethical Committee for Health Research (CNERS) of Chekhan Diop University of Dakar University and the boards of Nabil Choukair Health Center. This was cross-sectional, analytical and descriptive research carried out over 9 months between July 2020 and March 2021, the samples of which were taken from the Nabil Choucair Health Center in Dakar, Senegal, then transported and treated at the laboratory of bacteriology-virology of CHUN Aristide Le Dantec.

Criteria for Inclusion and Non-inclusion

The study included all pregnant patients aged between 34 and 38 weeks of gestation, without concomitant conditions, who attended regular antenatal ward at Nabil Chowcare Health Center with independent willingness will enter the research and obtain informed consent.

Those who had received antibiotic therapy, regardless of type or duration, within the 15 days before the consultation, as well as women experiencing pregnancy complications like placenta previa, vaginal bleeding, or underlying pathologies such as hypertension, diabetes, HIV, and labor, were excluded from the study.

Data Collection

Individual interviews were conducted to obtain information on reproductive health factors, including history of venereal disease, gestational age, associated infection and community symptoms, and a structured questionnaire was used for data collection mouth including socio-demographic factors such as age, marital status and level of education.

Specimen Collection and Transport

After being positioned in the gynecological position, each pregnant woman had a clinical and urogenital examination. A standard speculum examination without lubricant was performed, followed by collection from the posterior vaginal cul-de-sac with a sterile swab, kept in one milliliter of physiological water. Using pH indicator paper, the sample's pH was found. The discharge's color, appearance, and odor were among the other macroscopic features that were noted. Subsequently, the

© STM Journals 2024. All Rights Reserved

vaginal samples were dispatched to the Aristide Le Dantec Hospital's bacteriology laboratory in Dakar within a maximum of three hours.

Treatment in the Laboratory

Microscopic Examination and Bacterial Isolation

As soon as the samples arrived at the bacteriology lab, they were processed in accordance with standard laboratory procedures to identify and isolate pathogenic microorganisms. Leukocytes, red blood cells, and epithelial cells counting were performed using a wet mount made from a drop of vaginal secretion. *T. vaginalis* were identified by its characteristic shape and mobility [10]. Simultaneously, pseudohyphae or budding yeast cells were searched for with a 40 objective microscope. After that, the type, Nugent scoring, microbial flora, and vaginal flora were evaluated using a Gram stain [11]. Yeasts were cultured on Sabouraud-chloramphenicol medium [12]. E. coli was cultured. on eosin-methylene blue (EMB) agar (Merck, Darmstadt, Germany). Nalidixic acid (Bio-Rad, Marnes-la-Coquette, France) and Granada medium (Becton Dickinson GmbH, Heidelberg, Germany) cultured with fresh blood agar in parallel experiments for serving as anaerobic growth media for each GBS. Incubation at 37°C would take seventeen to twenty-four hours. [13].

Identification of Genital Microorganisms

Pure isolates of bacterial pathogens were identified by their cultural, morphological, biochemical and antigenic characteristics [14]. The Vitek 2 automated compact system (bio-Merieux, Craponne, France) was utilized to confirm the identification of GBS using GP (Gram-positive) cards [15].

Genital herpes was diagnosed by the Nugent method.According to this method, the overall score is 0–3 for a "normal" *Lactobacillus*-dominated microbiota, 4-6 for an "intermediate microbiota," and 7–10 for bacterial vaginosis [16].

Statistical Analysis

FileMaker Pro (version 16) was used to enter the study data. The Mann-Whitney Statistical System for the Social Sciences (SPSS; Chicago, IL, USA) is another. Using U and chi-squared tests, determine how different groups of continuous categorical variables correlate with each other. They are done in many ways.The related risk factors were evaluated using logistic regression. All statistical tests had a significance level of $p < 0.05$.

RESULTS OF THE STUDY

In all, 384 women between 16 and 46 years who were 34 to 38 weeks pregnant were included in the study. There were 227 women with LGTIs, a prevalence of 59.11% (227/384).

Socio-demographic Characteristics

Table 1 Describe the sociodemographic characteristics of pregnant women with low-grade cervical diseases. The statistical analysis's comprehensive findings demonstrated a statistically significant difference between the median age of women with lower genital infections (25 years) and women without infections (27 years). In particular, it was women in the age group [16–24] who had a slightly higher infection rate, estimated at 46.3% (105/227), compared with 44.9% (102/227) for women in the age group [25–34]. From age 35 onward, the infection rate was very low, estimated at 8.8% (20/227).

Regarding marital status, our study population consisted of 97.1% (373/383) married women and 2.9% (11/384) single women. Of women, half either, 59.5% (222/373), had a vaginal infection, compared with 45.5% (5/11) of the single women. Among married women, 14.7% (55/373) lived in a polygamous regime and 83.3% (189/373) in a monogamous regime. Infection was common in the polygamous group where it affected 69.1% (36/55). The incidence of LGTIs, however, did not correlate

© STM Journals 2024. All Rights Reserved

with either marital status (p = 0.350) or regime (p = 0.104)., Infections of the lower genital tract were more frequent among women with religious education (70.7%; 29/41) and among women with no education (62.3%; 43/69). Higher-educated women had lower rates of vaginal infections (46.7%; 21/45). however, no statistical association was found between education level and LGTIs. (p = 0.117).

Table 1. Socio-demographic characteristics of the study participants.

Pregnant women n (%)					
Parameters	***Classification***	***LGI (+) (n = 227)***	***LGI (-) (n = 157)***	***PP***	***P***
Age Group (years)	Median (IQR)	25 (22-30)	27 (22-30)		0.022
	16-24	105 (46.3)	54 (34.4)	66.0	
	25-34	102 (44.9)	78 (49.7)	56.7	
	35-46	20 (8.8)	25 (15.9)	44.4	
Marital status	Married	222 (97.8)	151 (96.2)	59.5	0.350
	Single	05 (2.2)	6 (3.8)	45.5	
Matrimonial regime	Monogamy	189 (83.,3)	140 (89.2)	57.4	0.104
	Polygamy	38 (16.7)	17 (10.8)	69.1	
Level of education	Not educated	43 (18.9)	26 (16.6)	62.3	0.117
	Primary	54 (23.8)	46 (29.3)	54	
	Secondary	80 (35.2)	49 (31.2)	62.0	
	Higher	21 (9.3)	24(15.3)	46.7	
	Religious	29 (12.8)	12 (7.6)	70.7	

LGI (+): with lower genital infections; LGI (-): without lower genital infections;
IQR: interquartile range; PP: partial prevalence; P: P-value

Clinical Characteristics

Clinical Symptoms

In our series, 44.0% (169/384) of volunteers had no symptoms of LGTIs. On the other hand, 55.9% (215/384) of the other women reported symptoms associated with the presence of a LGTI. The most frequent clinical manifestations were vaginal irritation felt in 81.4% (n = 118; p<0.001), followed by burning sensations evoked in 71.5% (n = 88; p = 0.001), dyspareunia incriminated in 72.9% (n = 43; p = 0.018) and pelvic pain complained of in 63.9% (n = 62; p = 0.266) of volunteers (Table 2). All these symptoms, except pelvic pain, were significantly associated with LGTI.

Table 2. Frequency of local symptoms and LGTI.

Pregnant women N (%)					
Parameters Characteristics		***LGI (+) (n = 227)***	***LGI (-) (n = 157)***	***PP***	***P***
Symptoms	Present	129 (57.1)	86 (54.8)	60.0	0.655
	Absent	97 (42.9)	71 (45.2)	57.7	
Dyspareunia	Present	43 (19.0)	16 (10.2)	72.9	0.018
	Absent	183 (81.0)	141 (98.8)	56.5	
Pelvic pains	Present	62 (27.3)	35 (22.3)	63.9	0.266
	Absent	165 (72.7)	122 (77.7)	57.5	
Burning sensation	Present	88 (38.8)	35 (22.3)	71.5	0.001
	Absent	139 (61.2)	122 (77.7)	25.5	
Irritations	Present	118 (52)	27(17.2)	81.4	0.001
	Absent	109 (48)	130 (82.8)	45.6	

LGI (+): with lower genital infections; LGI (-): without lower genital infections;

© STM Journals 2024. All Rights Reserved

PP: partial prevalence; P: P-value

Obstetrical Characteristics

Table 3 describes the gynecological-obstetrical characteristics of patients with lower genital infection. The median gestation in our study was 2 (1-2) pregnancies per woman. However, LGTI was more frequent in primigravida women with 63.2% (108/227) compared to 55.9% (63/157) in multigestin women. The median gestational age was 36 weeks (34-37). The infection rate was highest at 35 weeks' gestation with 76.7% (23/30) and at 36 weeks' gestation with 19.6% (28/45). The number of pregnancies, and the stage of pregnancy did not correlate with the incidence of LGTI (p = 0.300 and p= 0.146, respectively).

History of Stillbirths of the Study Participants

The history of stillbirth with the presence of LGTI was summarized in Table 4. The prevalence of stillbirth history in pregnant women with LGTI was 14.09% (32/227). They consisted of 8.81% (20/227) spontaneous abortions, 1.32% (3/227) retained dead egg (ROM), 0.44% (n =1) extras uterine pregnancies (EUP), and 0.88% (n =2) in utero fetal death and 2.64 (n = 6) pediatric deaths. The existence of an LGTI was positively correlated with the likelihood of unfavorable pregnancy outcomes (p = 0.020).

Laboratory Findings

Appearance of the Ectocervix

Upon examination of the vaginal mucosa, 65.6% (149/227) of the cases had a normal appearance of the ectocervix. In comparison, 18.5% (43/227) of the cases had an inflammatory appearance (of which 02 had the presence of Naboth's egg and 17 had bleeding at the cervical contact). In 21 women (9.2%) there was contact bleeding only. In 7.5% of cases or 17 women, the cervical cavity has not been observed. There was a correlation between bleeding on contact with the cervix and the presence of a LGI (p = 0.005).

Table 3. Obstetrical characteristics of the study participants.

Pregnant women n (%)					
Parameters	***Classification***	***LGI (+) (n = 227)***	***LGI (-) (n = 157)***	***PP***	***P***
Gestational age week of gestation (WG)	Median (IQR)	36 (34-37)	36 (34-37)		0.300
	34	82 (36.1)	65 (41.1)	55.8	
	35	23 (10.1)	07 (4.5)	76.7	
	36	28 (12.3)	17 (10.8)	62.2	
	37	44 (19.4)	30 (19.1)	59.5	
	38	50 (22.0)	38 (24.2)	56.8	
Gestures	Median (IQR)	2 (1-2)	2 (2-1)		0.149
	primary gestures	108 (47.6)	119 (52.4)	63.2	
	multigesture	63 (40.1)	94 (59.9)	55.9	

LGI (+): with low genital infection; LGI (-): without lower genital infections;
PP: partial prevalence; P: P-value.

Table 4. History of stillbirths of the study participants.

Pregnant women n (%)			
Parameters	**LGI (+) (n = 227)**	**LGI (-) (n = 157)**	**p**
History of stillbirths	32 (14.09)	29 (18.47)	0.020
Spontaneous abortions	20 (8.81)	20 (12.73)	
Retained dead egg	3 (1.32)	01 (0.63)	
Extras uterine pregnancies	1 (0.44)	0 (0.0)	
In utero fetal death	2 (0.88)	04 (2.54)	
Pediatric deaths	6 (2.64)	04 (2.54)	

© STM Journals 2024. All Rights Reserved

LGI (+): with lower genital infections; LGI (-): without lower genital infections; P: P-value

Table 5. Exocervical appearance in study participants.

Pregnant women n (%)					
Parameters Characteristics		***LGTI (+) (n =227)***	***LGTI (-) (n = 157)***	***Partial prevalence***	***p***
Ectocervix appearance	Normal	149 (65.6)	115 (73.2)	56.4	0.062
	Abnormal	61 (26.9)	31 (19.8)	66.3	
	Not seen	17 (7.5)	11 (7.0)	60.7	
Inflamed	Present	43 (18.9)	23 (14.7)	65.1	0.152
	Absent	167 (73.6)	123 (78.3)	57.6	
Bleeding on contact	Present	38 (16.7)	12 (7.6)	76	0.005
	Absent	172 (75.8)	134 (85.4)	57.4	

Table 6. Typing of vaginal flora.

Microbiote	Flora typing	Nugent score	infected	Not infected	pp
Normal		1-3	114 (50.2)	152 (96.8)	
	1		21 (9.25)	72 (45.9)	42.9
	2		93 (40.96)	80 (51.0)	22.6
Intermediary	3	4-6	19 (8.37)	4 (2.5)	53.8
Unbalanced			95 (41.85)		
	3	7-10	13 (5.72)	1(0.6)	
	4	7-10	81 (35.68)	0 (0.0)	88.9

Microbiological Characteristics

Types of Flora

In the present study, 40.9% (157/384) of the participants had a negative test result in the search for pathogenic microorganisms. Among them, 39.6% (152/384) had normal vaginal microbiota and 1.3% (5/384) had intermediate flora. Among the volunteers with lower genital infection, 50.2% (114/227) had normal vaginal flora, 8.4% (19/227) intermediate vaginal flora and 41.9% (95/384) unbalanced vaginal flora as detailed in Tables 5 and 6.

Microorganisms Isolated

In the laboratory, nearly 342 significant microorganisms had been identified by standard techniques. They consisted of 48.24% (n=164) *Candida* spp. isolates, 9.06% (n = 31) GBS strains, and 0.78% (n = 3) *E. coli* strains. Morphotypes identified by microscopy were 32.75% (n=112) *G. vaginalis*; 7.90% (n=27) *Mobiluncus* spp. and 1.46% (n = 5) *T. vaginalis* as shown in the following Figure 1.

Among these germs 38.30% (131/343) were responsible for simple infections and 61.70% (211/343) were associated mixed infections. These simple infections were found in 57.71% (n = 131/227) of the volunteers and was distributed in: 40.97% (n = 93) cases of vulvo-vaginal candidiasis (VVC), into 15.86% (n = 36) cases of G. vaginalis (GV) bacterial vaginosis and 0.88% (n = 2) cases of vaginal Trichomonas as represented in Table 7.

Mixed infections were present in 42.29% (n = 96) of participants. There were 33.92% (n = 77) cases of 2 germ infections of which the most frequent was CV-GV co-infection at 16.74% (n = 38), followed by cases of BV with GV associated with *Mobiluncus* spp. at 7.93% (18/227) and the association *Candida* spp-GBS at 6.61% (15/227).

© STM Journals 2024. All Rights Reserved

The infections with three germs were 17 (7.48%) of which the most significant were the co-infections VVC-GV-GBS (n = 9) and VVC-GV-MOB (n = 4). infections with four germs constituted by the association VVC-GV-MOB-GBS were found in 2 (0.88%) volunteers, as indicated in Table 7.

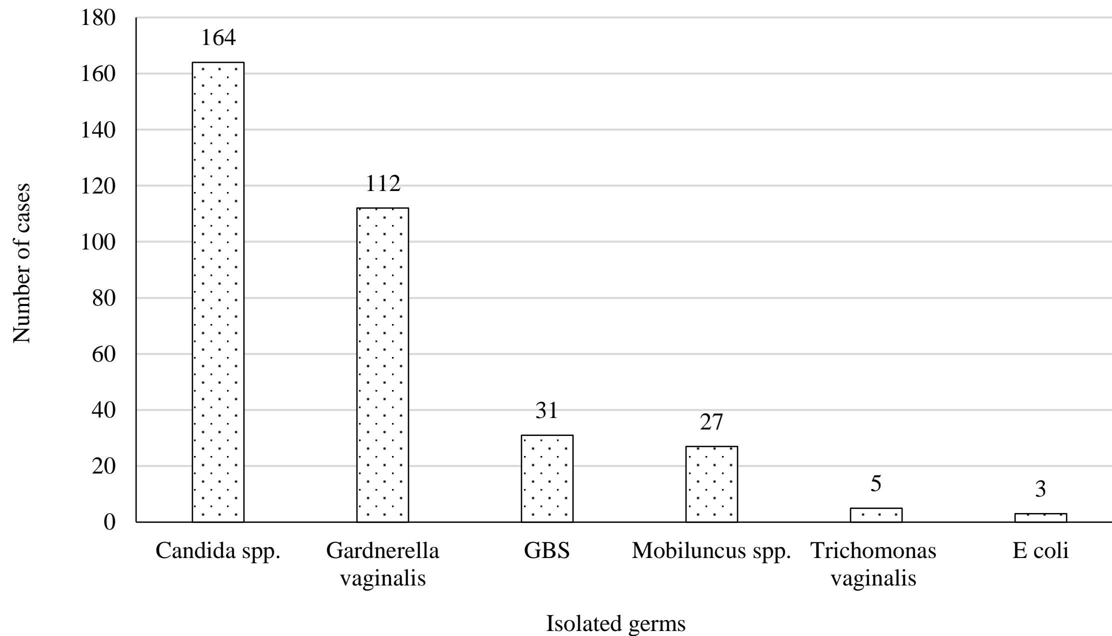

Figure 1. Distribution of the isolated micro-organisms.

Table 7. Distribution of micro-organisms.

Type of infection	Number	Germs isolated	Number (%)
Simple infection	131 (57.7%)		
		Candida spp.	93 (40.9)
		Gardnerella vaginalis	36 (15.86)
		Trichomonas vaginalis	02 (0.88)
Mixed infection	96 (42.3%)		
with 2 germs	75 (31.71%)	*C. albicans/G. vaginalis*	38 (16.29)
		Candida spp.- groupe B *Streptococcus* (GBS)	15 (6.60)
		Candida spp-*E. coli*	02 (0.44)
		G. vaginalis –Mobiluncus spp.	18 (7.92)
		G. vaginalis-GBS	01 (0.44)
		G. vaginalis-E. coli	01 (0.44)
		T. vaginalis-G. vaginalis	01 (0.44)
		T. vaginalis-GBS	01 (0.44)
3 germs	17 (7.48%)		
		C. albicans-G. vaginalis-GBS	09 (3.96)
		C. albicans-G. vaginalis-Mobiluncus	04 (1.76)
		G. vaginalis-Mobiluncus-GBS	03 (1.32)
		T. vaginalis-C. albicans-BV	01 (0.44)
4 germs	2 (0.88%)		
		C. albicans-G. vaginalis-Mobiluncus-GBS	02 (0.88)
Total	227 (100)		227 (100)

Risk Factors

© STM Journals 2024. All Rights Reserved

Multivariate analysis was performed using LGTI with significant correlation and p-value less than 0.05. Among the factors, the age distribution of women (p = 0.022) was statistically associated, as were susceptibility to vaginal irritation (n = 118; p < 0.000), burning sensation (n = 88; p < 0.001), and dyspareunia (n = 43; p = 0.018).

Table 8. Associated risk factors.

Parameters	N (%)	p	OR	IC à 95 %
Age distribution	227 (100)	0.02		
Dyspareunia	43 (19.0)	0,018	2,07	1.12-3.82
Urinary burning	88 (38.8)	0.001	2.20	1.39-3.49
Vulvar irritation	118 (52)	0.001	5.21	3.19-8.50
White leucorrhoea	151 (66.5)	0.002	0.47	0.28-0.76
Yellow leukorrhea	51 (22.5)	0.001	3.84	1.93-7.64
Adverse pregnancy outcomes	30 (13.2)	0.02	0.49	0.27-0.90
Bleeding at the ectocervix contact	38 (18.2)	0.005	2.48	1.24-4.93
Microscopic inflammatory reaction	69 (30.39)	0.001	4.83	2.56-9.12

P: p-value; OR: odd ratio

LGTI was also associated with adverse pregnancy outcomes (n = 22; p = 0.020), bleeding in contact with the cervix (n = 38; p = 0.005), white (n = 151, p < 0.002) or yellow leucorrhoea (n = 51; p < 0.000) as represented in Table 8. Multivariate analysis revealed that women with LGTIs were younger and 60% more likely to experience clinical symptoms such as dyspareunia, urinary burning, and vulvar irritation than women without infection.

Women with LGTIs were 2 times (95% CI = 1.3-3.4) more likely to report burning and dyspareunia (95% CI = 1.1-3.8) and were 5.2 times (95% CI = 3.2-8.5) more sensitive to vulvar irritation. These results suggest that symptoms can be used to identify women with LGTIs. Among other risk factors associated with LGTIs, the color of vaginal secretions was a confirmed predictive risk factor. Yellowish leucorrhoea from vaginal discharge was almost 4 times more common in infected women than in uninfected women. (OR = 3.84; p = 0.001). This analysis also showed that the risk factors statistically correlated with infection were bleeding on contact with the ectocervix with or without ectocervical inflammation. The probability of carrying a lower genital infection was 2.48 times greater in women with bleeding from the ectocervix than in women with healthy ectocervix (OR = 2.48; p = 0.005). At the microbiological level, inflammatory smears were positively associated with the probability of diagnosing a lower genital infection (OR = 4.83; p = 0.001). The risk of an adverse pregnancy outcome was multiplied by a factor of 1 in 2 in the case of LGTI in pregnant women (OR = 0.49; p = 0.02), as presented in Table 8.

DISCUSSION

Worldwide, women, especially those in their reproductive years, are at risk of developing lower genital tract infections. In this study, the prevalence of germs, which cause vulvovaginal infections such as vulvovaginal candidiasis (VVC), bacterial vaginoses (BV), and *Trichomoniasis* v*aginalis* (TV) were associated with different factors. Thus, among 384 volunteers screened, lower genital infections were found in 227, with a prevalence of 59.11% (227/384) broken down into 42.7% VVC, 29.16% BV and 1.76% TV.

In Senegal, a similar study had shown a prevalence of 69.6% (192 out of 276) for any type of genital infection [17]. This higher prevalence than that observed in our study is explained by the recruitment of women who came to the clinic with signs and symptoms of genital infection. Similar high prevalence results had been reported in other African countries, namely in Ghana (56.4%), [18] Cameroon (68.7%) [19], Tanzania (65.3%) [20], Ethiopia (56%) [21] and confirm the high prevalence of vaginal infections among pregnant women, which could be due to unfavorable socioeconomic conditions, personal hygiene and cultural practices of the study participants and difficulties related to access to care.

© STM Journals 2024. All Rights Reserved

In the present study, significant proportions of vaginal infections were reported due to vaginal candidiasis at 42.7% (164/384). These findings were confirmed by research carried out in Côte d'Ivoire (43%) [22], Benin (56.2%) [23], Ethiopia (41.4%) [24], Egypt (50.4%) [25], and Vietnam (51.3%) [26].
Otherwise, a local study had shown a Candida spp carriage rate of 26.08% in pregnant women [27]. The meta-analysis in Africa confirmed this trend, with a rate of 29.2% [28]. Vaginal candida albicans infection rates in these proportions were recorded in Mauritania (26%) [29], Burkina Faso (22.7%) [30], and Gabon (28.52%), as well as in Cote d'Ivoire (23%) [31].

The high rate of vaginal *Candida* spp. colonization may have been influenced by the study participants' pregnancy. Pregnancy is a major factor in both colonization and infection, even though 20–50% of women carry candida species without exhibiting symptoms. Pregnancy has been linked in certain studies to the colonization of *Candida* spp [32] This is because pregnant women have high estrogen concentrations, which create an ideal environment for yeast growth. However, research indicates that a higher risk of preterm birth and low birth weight may be associated with *Candida* spp. colonization, which is why this high rate necessitates immediate attention to the infection [33, 34].

In our study also we observed a frequent association of *Candida* spp. and GBS (11.45%; 26/227), known to be a major neonatal pathogen. Variations in diagnostic techniques involving the use of culture on particular media that increase the isolation rates of yeasts may be the cause of the discrepancy in VVC prevalence rates across studies [35].

Due to their statistical association in our series, these symptoms that were linked to vulvovaginal infections have significant social and psychological ramifications in addition to becoming an epidemiological and clinical issue. In our study, 29.2% (112/384) of women were detected with BV. This rate of BV was quite close to that found in local studies (39.5% and 18.6%) [36] Additionally, these findings concurred with research conducted in Cameroun (26.2%) [37] or in Yemen (27.2%) [38]. The most common vaginosis in sexually active women is bacterial vaginosis.39G. Cervical infections can spread quickly during pregnancy. As a result, bacterial vaginosis may be seen in 15-20% of all pregnant women. In our series, 38% of volunteers diagnosed with Gardnerella vaginalis bacterial vaginosis showed no clinical symptoms of infection. *G. vaginalis* was the most common pathogen found in mixed infections in association with *Candida* spp. (n = 39) or *Mobiluncus* spp. (n=18). Due to the lack of predictive factors and the high risk of untreated infection that could harm the fetus, some have called for routine BV screening of all pregnant women. In our series, *T. vaginalis* was the least observed infection with a prevalence of 1.30 % (5/384) compared to other infections (VVC = 42.7% and BV = 29.16%) and in comparison to previous studies in the same geographical location (2.5%; 3.07% 4,8 % [40]), and in other parts of the world such as Nigeria (2%) [41], Ghana (1.4%), Yemen (0.9%) [42] or and Ethiopia (3.3%) [43]. The disparities in trichomoniasis observed across these various studies may result from participant differences in terms of economic status, culture, and personal hygiene habits. Furthermore, the actual prevalence may have been lowered in this study if *T. vaginalis* had not been found using the traditional wet mount method. Apart from the variation in these isolation rates, the global prevalence of trichomoniasis appears to be relatively low. It has declined relative to other infections and is reported to range from 3.9 to 24.6% [44].

In the series, *T. vaginalis* was only found in volunteers over 35 years of age, an event already described in a previous study [45].

In our study, the appearance of the ectocervix, particularly in our case, bleeding on contact with the ectocervix, is a factor significantly associated with lower genital infections. Numerous studies have already reported on this [46]. Cervical appearance was known to be associated with *Candida* carriage. Variations from normal appearance to inflammation and bleeding on contact were correlated

© STM Journals 2024. All Rights Reserved

respectively at 2.8 with CVV and 2.8 in our series with vaginal infections in general. Inspection of the ectocervix is an important aspect that should be informed at the time of sampling and taken into consideration at the time of diagnosis, and the infection in question treated as quickly as possible to preserve the integrity of the cervix.

CONCLUSION

Microbial colonization of the vaginal sphere during pregnancy is common. Alteration of the genital microbiota during pregnancy may involve interactions between the infectious agent and maternal immunity and may lead to an inflammatory response in the ectocervix and adverse pregnancy outcomes. Thus, it seems imperative to promptly diagnose and treat exhibiting symptoms associated with lower genital infections during pregnancy.

Author Contributions

NSN, GL, OG, and MC had performed the experiments. Data were analyzed using DGN and SMN. NSN and AT wrote the first draft of the manuscript, who also worked together to refine the concept and structure of the article. The manuscript was written with the help of ABD and HDN. AD and MC approved the final product after careful evaluation. After reviewing and approving the completed manuscript, each author agrees with the results and conclusions.

Disclosure by an interested party
The authors disclaim any potential conflicts of interest regarding the research, writing, and/or publication of this paper.

Ethical issues

Ethical warrants matched each precondition. The study was approved by the authorities of the Ministry of Health and the National Policy Committee for Health Research (CNERS) of Chekhan Diop University, University of Dakar. The aims of the study were disclosed to those who gave written and verbal consent. If they chose not to participate in the trial, patients' treatment remained ineffective. Participants' confidentiality was coded and carefully protected. The patients received all the findings of the study. Those who tested positive were notified by medical professionals and provided the care they needed.Abbreviations

LGI:	low genital infections
LGTI:	lower genital tract infection
BV:	Bacterial vaginosis
CVV:	Vulvo-vaginal candidiasis
Mob:	*Mobilluncus spp*
GBS:	*Group B Streptococcus*
TV:	*Trichomonas vaginalis*
WG:	week of gestation
GV:	*Gardnerella vaginalis*
spp.:	species

REFERENCES

1. Bagga, R., and Arora, P. (2020). Genital Micro-Organisms in Pregnancy. Frontiers in public health, 8, 225. https://doi.org/10.3389/fpubh.2020.00225
2. Ravel, J., Gajer, P., Abdo, Z., Schneider, G. M., Koenig, S. S., & McCulle, S. L. (2011). Vaginal microbiome of reproductive-age women. Proceedings of the National Academy of Sciences of the United States of America, 108 Suppl 1(Suppl 1), 4680–4687. https://doi.org/10.1073/pnas.1002611107
3. WHO Global Maternal Sepsis Study (GLOSS) Research Group. Frequency and management of maternal infections in health facilities in 52 countries (GLOSS): an initial 1-week cohort study. Lancet Glob Health. 2020;8(5):e661-e671. doi:10.1016/S2214-109X(20)30109-1

© STM Journals 2024. All Rights Reserved

4. Maternal and neonatal mortality in Senegal: 315 deaths per 100,000 live births | Fonds Francais Muskoka (ffmuskoka.org) https://news.un.org/fr/story/2019/09/1052012.
5. https://dumas.ccsd.cnrs.fr/dumas-04504443v1/file/2023_BONNAL%20Valentine.pdfOwen, M. K., & Clenney, T. L. (2004). Management of vaginitis. American family physician, 70(11), 2125–2132.
6. Salinas, A. M., Osorio, V. G., Endara, P. F., Salazar, E. R., Vasco, G. P., Vivero, S. G., & Machado, A. (2018). Bacterial identification of the vaginal microbiota in Ecuadorian pregnant teenagers: an exploratory analysis. PeerJ, 6, e4317. https://doi.org/10.7717/peerj.4317.
7. Nugent, R. P., Krohn, M. A., & Hillier, S. L. (1991). Reliability of diagnosing bacterial vaginosis is improved by a standardized method of gram stain interpretation. Journal of clinical microbiology, 29(2), 297–301. https://doi.org/10.1128/jcm.29.2.297-301.1991.
8. Aagaard, K., Riehle, K., Ma, J., Segata, N., Mistretta, T. A., & Coarfa, C. (2012). A metagenomic approach to characterization of the vaginal microbiome signature in pregnancy. PloS one, 7(6), e36466. https://doi.org/10.1371/journal.pone.0036466.
9. Domeika, M., Zhurauskaya, L., Savicheva, A., Frigo, N., Sokolovskiy, E., Hallén, A., & Eastern European Network for Sexual and Reproductive Health (2010). Guidelines for the laboratory diagnosis of trichomoniasis in East European countries. Journal of the European Academy of Dermatology and Venereology: JEADV, 24(10), 1125–1134. https://doi.org/10.1111/j.1468-3083.2010.03601.x
10. Froböse, N. J., Bjedov, S., Schuler, F., Kahl, B. C., Kampmeier, S., & Schaumburg, F. (2020). Gram Staining: a Comparison of Two Automated Systems and Manual Staining. Journal of clinical microbiology, 58(12), e01914-20. https://doi.org/10.1128/JCM.01914-20
11. Matheson, A., & Mazza, D. (2017). Recurrent vulvovaginal candidiasis: A review of guideline recommendations. The Australian & New Zealand journal of obstetrics & gynaecology, 57(2), 139–145. https://doi.org/10.1111/ajo.12592.
12. Franco-Duarte, R., Černáková, L., Kadam, S., Kaushik, K. S., Salehi, B., Bevilacqua, A., & al. (2019). Advances in Chemical and Biological Methods to Identify Microorganisms-From Past to Present. Microorganisms, 7(5), 130. https://doi.org/10.3390/microorganisms7050130.
13. De La Rosa, M., Villareal, R., Vega, D., Miranda, C., & Martinezbrocal, A. (1983). Granada medium for detection and identification of group B streptococci. Journal of clinical microbiology, 18(4), 779–785. https://doi.org/10.1128/jcm.18.4.779-785.1983.
14. Nugent, R. P., Krohn, M. A., & Hillier, S. L. (1991). Reliability of diagnosing bacterial vaginosis is improved by a standardized method of gram stain interpretation. Journal of clinical microbiology, 29(2), 297–301. https://doi.org/10.1128/jcm.29.2.297-301.1991
15. Diadhiou, M., Ba Diallo, A., Barry, M. S., Alavo, S. C., Mall, I., Gassama, O., Ndiaye Guèye, M. D & al. (2019). Prevalence and Risk Factors of Lower Reproductive Tract Infections in Symptomatic Women in Dakar, Senegal. Infectious diseases, 12, 1178633719851825. https://doi.org/10.1177/1178633719851825.
16. Konadu, D. G., Owusu-Ofori, A., Yidana, Z., Boadu, F., Iddrisu, L. F., Adu-Gyasi, D., Dosoo, D., & al. Prevalence of vulvovaginal candidiasis, bacterial vaginosis and trichomoniasis in pregnant women attending antenatal clinic in the middle belt of Ghana. BMC pregnancy and childbirth, 19(1), 341. https://doi.org/10.1186/s12884-019-2488-z.
17. Dickson, S. N., Denis, Z., Jules-Clement, N. A., Anna, L. N., Che Denis Nchang, Neville MvoNgum, Weledji Elroy Patrick, and NgoweNgowe Marcelin, “The Epidemiology of Trichomonas vaginalis, Gardnerella vaginalis and Candida albicans Co- Infections in Women Attending the Yaounde University Teaching Hospital.” American Journal of Epidemiology and Infectious Disease, vol. 3, no. 2 (2015): 28-31. doi: 10.12691/ajeid-3-2-2.
18. Majigo, M. V., Kashindye, P., Mtulo, Z., & Joachim, A. (2021). Bacterial vaginosis, the leading cause of genital discharge among women presenting with vaginal infection in Dar es Salaam, Tanzania. African health sciences, 21(2), 531–537. https://doi.org/10.4314/ahs.v21i2.7.
19. Yasin, J., Ayalew, G., Dagnaw, M., Shiferaw, G., & Mekonnen, F. (2021). Vulvovaginitis Prevalence Among Women in Gondar, Northwest Ethiopia: Special Emphasis on Aerobic Vaginitis

© STM Journals 2024. All Rights Reserved

Causing Bacterial Profile, Antimicrobial Susceptibility Pattern, and Associated Factors. Infection and drug resistance, 14, 4567–4580. https://doi.org/10.2147/IDR.S337205

20. Konaté, A., Yavo, W., Kassi, F. K., Djohan, V., Angora, E. K., Barro-Kiki, P. C., Bosson-Vanga, H., Soro, F., & Menan, E. I. (2014). Aetiologies and contributing factors of vulvovaginal candidiasis in Abidjan (Cote d'Ivoire). Journal de mycologie medicale, 24(2), 93–99. https://doi.org/10.1016/j.mycmed.2013.11.006.
21. Fanou, B. A., Klotoe, J. R., Dougnon, V., Monteiro, A., Koudokpon, C. H., & Loko, F. (2022). Prevalence and factors associated with vulvovaginal candidiasis in women admitted to the Zone Hospital of Mènontin (Bénin). The Pan African medical journal, 42, 215. https://doi.org/10.11604/pamj.2022.42.215.28984
22. Bitew, A., & Abebaw, Y. (2018). Vulvovaginal candidiasis: species distribution of Candida and their antifungal susceptibility pattern. BMC women's health, 18(1), 94. https://doi.org/10.1186/s12905-018-0607-z.
23. Elfeky, D.S., Gohar, N.M., El-Seidi, E.A., Ezzat, M., & AboElew, S.H. (2016). Species identification and antifungal susceptibility pattern of Candida isolates in cases of vulvovaginal candidiasis. Alexandria Journal of Medicine, 52, 269 - 277.
24. Anh, D. N., Hung, D. N., Tien, T. V., Dinh, V. N., Son, V. T., Luong, N. V., & al. (2021). Prevalence, species distribution and antifungal susceptibility of Candida albicans causing vaginal discharge in symptomatic non-pregnant women of childbearing age in a tertiary care hospital, Vietnam. Infectious diseases BMC, 21(1), 523. https://doi.org/10.1186/s12879-021-06192-7.
25. Sylla K, Sow D, Lakhe NA, Tine RC, Dia M, Lelo S et al. Vulvo-vaginal candidiasis in the Parasitology-Mycology laboratory of the Centre Hospitalier Universitaire de Fann, Dakar (Senegal). Rev Cames Santé. 2018;5(2): 21-27 G. PubMed| Google Scholar.
26. Osman Mohamed, A., Suliman Mohamed, M., Hussain Mallhi, T., Abdelrahman Hussain, M., Ali Jalloh, M., Ali Omar, K., & al. (2022). Prevalence of vulvovaginal candidiasis among pregnant women in Africa: A systematic review and meta-analysis. Journal of infection in developing countries, 16(8), 1243–1251. https://doi.org/10.3855/jidc.15536.
27. Sy, O., Diongue, K., Ahmed, C. B., Ba, O., Moulay, F. C., Lo, B., & Ndiaye, D. (2018). Vulvovaginal candidiasis in pregnant women in the Mère et Enfant Hospital center in Nouakchott, Mauritania. Journal de mycologie medicale, 28(2), 345–348. https://doi.org/10.1016/j.mycmed.2018.02.006.
28. Sangaré, I., Sirima, C., Bamba, S., Zida, A., Cissé, M., Bazié, W. W., Sanou, S., Dao, B., Menan, H., & Guiguemdé, R. T. (2018). Prevalence of vulvovaginal candidiasis in pregnancy at three health centers in Burkina Faso. Journal de mycologie medicale, 28(1), 186–192. https://doi.org/10.1016/j.mycmed.2017.08.006.
29. Djohan, V., Angora, K. E., Vanga-Bosson, A. H., Konaté, A., Kassi, K. F., Kiki-Barro, P. C. M., Bedia-Tanoh, A. V., Miezan, S., Menan, E. I. H., & Yavo, W. (2019). Recurrent vulvo-vaginal candidiasis in Abidjan (Côte d'Ivoire): Aetiology and associated factors. Journal de mycologie medicale, 29(2), 127–131. https://doi.org/10.1016/j.mycmed.2019.04.002.
30. Leli, C., Mencacci, A., Meucci, M., Bietolini, C., Vitali, M., Farinelli, S., D' Alò, F., Bombaci, J. C., Perito, S., & Bistoni, F. (2013). Association of pregnancy and Candida vaginal colonization in women with or without symptoms of vulvovaginitis. Minerva ginecologica, 65(3), 303–309.
31. Schuster HJ, de Jonghe BA, Limpens J, budding A. AE, Painter RC. Asymptomatic vaginal Candida colonization and adverse pregnancy outcomes, including preterm birth: a systematic review and meta-analysis. Am J Obstet Gynecol MFM. 2020;2(3):100163.
32. Sule-Odu, A. O., Akadri, A. A., Oluwole, A. A., Osinupebi, O. A., Andu, B. A., Akiseku, A. K., & Lawal, A. I. (2020). Vaginal Candida infection in pregnancy and its implications for fetal well-being. African journal of reproductive health, 24(3), 33–40. https://doi.org/10.29063/ajrh2020/v24i3.4
33. Mtibaa, L., Fakhfakh, N., Kallel, A., Belhadj, S., Belhaj Salah, N., Bada, N., & Kallel, K. (2017). Vulvovaginal candidiasis: Etiology, symptomatology and risk factors. Journal de mycologie medicale, 27(2), 153–158. https://doi.org/10.1016/j.mycmed.2017.01.003.

© STM Journals 2024. All Rights Reserved

34. Bonneton, M., Huynh, B. T., Seck, A., Bercion, R., Sarr, F. D., Delarocque-Astagneau, E., & Vray, M. (2021). Bacterial vaginosis and other infections in pregnant women in Senegal. BMC infectious diseases, 21(1), 1090. https://doi.org/10.1186/s12879-021-06767-4.
35. Kamga, Y. M., Ngunde, J. P., & Akoachere, J. K. T. (2019). Prevalence of bacterial vaginosis and associated risk factors in pregnant women receiving antenatal care at the Kumba Health District (KHD), Cameroon. BMC pregnancy and childbirth, 19(1), 166. https://doi.org/10.1186/s12884-019-2312-9.
36. Abdul-Aziz, M., Mahdy, M. A. K., Abdul-Ghani, R., Alhilali, N. A., Al-Mujahed, L. K. A., Alabsi, S. A& al. (2019). Bacterial vaginosis, vulvovaginal candidiasis and trichomonal vaginitis among reproductive-aged women seeking primary healthcare in Sana'a city, Yemen. BMC infectious diseases, 19(1), 879. https://doi.org/10.1186/s12879-019-4549-3.
37. Koumans, E. H., Sternberg, M., Bruce, C., McQuillan, G., Kendrick, J., Sutton, M., & Markowitz, L. E. (2007). The prevalence of bacterial vaginosis in the United States, 2001-2004; associations with symptoms, sexual behaviors, and reproductive health. Sexually transmitted diseases, 34(11), 864–869. https://doi.org/10.1097/OLQ.0b013e318074e565.
38. Tine, R. C., Sylla, K., Ka, R., Dia, L., Sow, D., Lelo, S., & al. (2019). A study of Trichomonas vaginalis infection and correlates in women with vaginal discharge referred to Fann University Hospital, Senegal. Journal of parasitology research, 2019, 2069672. https://doi.org/10.1155/2019/2069672
39. Abdullahi, B. and Danyaya, R. (2021): Prevalence of Candida Albicans and Trichomonas vaginalis Infection among Women Presenting With Vaginitis in Jama'a Hospital, Samaru, Zaria, Nigeria BJMLS. 6(2):69 – 77.
40. Abdul-Aziz, M., Mahdy, M.A.K., Abdul-Ghani, R. et al. Bacterial vaginosis, vulvovaginal candidiasis, and trichomonal vaginitis among women of reproductive age seeking primary health care in Sana'a City, Yemen. BMC Infect Dis 19, 879 (2019). https://doi.org/10.1186/s12879-019-4549-3
41. Zenebe, M. H., Mekonnen, Z., Loha, E., & Padalko, E. (2021). Prevalence, risk factors and association with delivery outcomes of curable sexually transmitted infections among pregnant women in southern Ethiopia. PloS one, 16(3), e0248958. https://doi.org/10.1371/journal.pone.0248958
42. Rowley, J., Vander Hoorn, S., Korenromp, E., Low, N., Unemo, M., Abu-Raddad, L. J., Chico, R. M., Smolak, A., & al. (2019). Chlamydia, gonorrhoea, trichomoniasis and syphilis: global prevalence and incidence estimates, 2016. Bulletin of the World Health Organization, 97(8), 548–562P. https://doi.org/10.2471/BLT.18.228486.
43. Van Gerwen, O. T., & Muzny, C. A. (2019). Recent advances in the epidemiology, diagnosis, and management of Trichomonas vaginalis infection. F1000Research, 8, F1000 Faculty Rev-1666. https://doi.org/10.12688/f1000research.19972.1.
44. Fanou, B. A., Klotoe, J. R., Dougnon, V., Monteiro, A., Koudokpon, C. H., & Loko, F. (2022). Prevalence and factors associated with vulvovaginal candidiasis in women admitted to the Zone Hospital of Mènontin (Bénin)]. The Pan African medical journal, 42, 215. https://doi.org/10.11604/pamj.2022.42.215.28984.
45. Sylla K, Sow D, Lakhe NA, Tine RC, Dia M, Lelo S et al. Vulvo-vaginal candidiasis in the Parasitology-Mycology laboratory of the Centre Hospitalier Universitaire de Fann, Dakar (Senegal). Rev Cames Santé. 2018;5(2): 21-27 G.

© STM Journals 2024. All Rights Reserved