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Etiology of vaginal infections and antimicrobial resistance pattern of aerobic bacterial isolates in women of reproductive age group attending a tertiary care hospital

Kritika Pal, Shailpreet K. Sidhu*, Pushpa Devi, Sita Malhotra, Anuradha Malhotra, Sapna Soneja

Department of Microbiology, Government Medical College, Amritsar, Punjab, India

ABSTRACT

Background: The vaginal flora is a complicated environment containing dozens of microbiological species in variable quantities and relative proportions. Many women with vaginitis may remain undiagnosed and such forms of abnormal vaginal neither considered as normal nor can be called bacterial vaginosis and are termed as "intermediate flora" and its management probably differs from that of bacterial vaginosis. It is of crucial importance in pregnant females at risk of preterm delivery. **Materials and Methods:** Six hundred and ten high vaginal swabs both from indoor and outdoor patients were collected and cultured, and their susceptibility to various antimicrobials was determined by standard methods. **Result:** Significant growth was obtained in 357 (58.5%) samples. Among the positive samples, 314 were positive for aerobic bacterial isolates, and 43 showed the growth of *Candida* species. The common aerobic isolates were *Escherichia coli* (24.92%), *Klebsiella pneumoniae* (23.50%), *Staphylococcus aureus* (16.52%), *Enterococcus* species (8.40%), and coagulase-negative *Staphylococcus* (6.44%). About two-third of the positive samples (71.0%) were from outdoor patients, while one-third (29%) were from indoor patients. The highest frequency of infection was observed at 25-30 years followed by 31-35 years of age group. The prevalence of aerobic vaginitis cases was higher among nonpregnant compared to pregnant cases. The Gram-positive organisms showed maximum resistance to ampicillin, followed by aminoglycosides, and ciprofloxacin. The Gram-negative isolates showed maximum resistance to ciprofloxacin followed by ceftriaxone, ceftazidime, gentamicin, and amikacin. **Conclusion:** The high prevalence of gynecological infections demands that the patients with gynecological symptoms be investigated thoroughly. As the culture provides, the identification of causative microorganisms, it must invariably be done.

Key words: Aerobic vaginitis, antimicrobial resistance, vaginal infections

INTRODUCTION

The vaginal microflora is a complex environment composed of varying microbiological species in variable quantities and relative proportions.[1]

Vaginitis is the inflammation and infection of vagina commonly encountered in clinical medicine. Whether infectious or not, vaginitis poses one of the most common problems in gynecology and is one of the main reasons, leading the females to seek advice from a physician approximately 10 million office visits annually.[2-4] Some pathological conditions causing vaginitis are well-defined such as bacterial vaginosis, vulvovaginal candidiasis, and trichomoniasis, yet, 7-72% of women with vaginitis may remain undiagnosed, and its management probably differs from that of bacterial vaginosis.[5] The problem is that some forms of abnormal vaginal microflora are neither normal nor can they be called bacterial vaginosis. Such forms of abnormal flora have been termed "intermediate flora" in some studies or been included with full-blown bacterial vaginosis in others. This type of undefined abnormal flora may be of crucial importance in pregnant women at risk of preterm delivery.[5-7] Aerobic vaginitis (AV) is caused by a displacement of the healthy vaginal *Lactobacillus* species with aerobic pathogens such as *Enterococcus faecalis, Escherichia coli,* and *Staphylococcus aureus* that triggers a localized vaginal inflammatory immune response.[8]

The present study is designed to isolate and identify the aerobic bacterial pathogens associated with vaginitis in the reproductive age group women and to study their latest antibiotic resistance pattern.

MATERIALS AND METHODS

A retrospective study was carried out in a tertiary care center during a period of 1 year from January 2016 to December 2016. Vaginal swabs were taken from females in their reproductive age groups (15-45 years) with symptomatic vaginal discharge attending the gynecology department. A total of six hundred and ten high vaginal swabs were received in the microbiology

Address for correspondence:
Dr. Shailpreet K. Sidhu, Department of Microbiology, Government Medical College, Amritsar, Punjab, India. E-mail: shail78@hotmail.com

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laboratory for processing. All the samples were processed by standard methodology.[9] The aerobically incubated organisms were identified with the help of colonial morphology, gram staining, and biochemical analysis. Isolated organisms were subjected to sensitivity testing by Kirby-Bauer disc diffusion method, using Clinical Laboratory Standards criteria 2017, to interpret diameter of inhibition zone.[10]

RESULTS

Of all the cultured samples (610), significant growth was obtained in 357 (58.5 %) samples. Among the positive samples, 314 were positive for aerobic bacterial isolates, and 43 showed the growth of *Candida* species. About two-third of the positive samples (71.0%) were from outdoor patients, while one-third (29%) were from indoor patients. The highest frequency of infection was observed at 25-30 years followed by 31-35 years of age group [Table 1]. The prevalence of AV cases was higher among nonpregnant compared to pregnant cases [Figure 1].

There was greater predominance of Gram-negative isolates than Gram-positive isolates. The common aerobic isolates were *E. coli* (24.92%), *Klebsiella pneumoniae* (23.50%), *S. aureus* (16.52%), *Enterococcus* species (8.40%), and coagulase-negative *staphylococcus* (6.44%) [Table 2].

The Gram-positive organisms showed maximum resistance to ampicillin, followed by aminoglycosides (amikacin, gentamicin), and ciprofloxacin. Among the *E. faecalis*, only 3 (10.0%) showed high-level resistance to gentamicin (120 µg), and 2 (6.6%) isolates were resistant to vancomycin (VAR). Among the *S. aureus*, 3 (5.08%) isolates were resistant to methicillin. All Gram-positive isolates were found to be sensitive to linezolid [Table 3a].

The Gram-negative isolates showed maximum resistance to ciprofloxacin followed by ceftriaxone, ceftazidime, gentamicin, and amikacin. Maximum sensitivity was shown to imipenem, sulbactam-ceftazidime, and piperacillin-tazobactam [Table 3b].

Table 1: Age wise distribution of AV cases

Age group	Number of cases studied (*n*=610)	Number of positive cases (*n*=357) (%)
15-20	30	6 (20.00)
21-25	61	31 (52.45)
26-30	279	182 (65.27)
31-35	143	86 (60.10)
36-40	65	35 (53.84)
41-45	32	16 (50.00)

AV: Aerobic vaginitis

Table 2: Distribution of organisms isolated from AV cases

Aerobic isolates	*n* (%)
E. coli	89 (24.92)
K. pneumoniae	84 (23.50)
S. aureus	59 (16.52)
Enterococcus species	30 (8.40)
Coagulase-negative *Staphylococcus*	23 (6.44)
Acinetobacter species	16 (4.48)
Pseudomonas species	9 (2.52)
Citrobacter species	3 (0.84)
Proteus species	1 (0.20)
Candida species	43 (12.04)

E.coli: Escherichia coli, S. aureus: Staphylococcus aureus, K. pneumoniae: Klebsiella pneumoniae, AV: Aerobic vaginitis

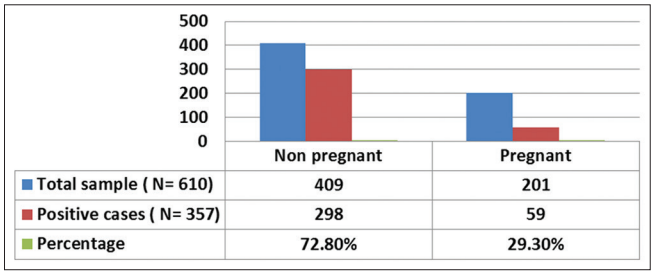

Figure 1: Distribution of aerobic vaginitis among pregnant and nonpregnant women

DISCUSSION

Vaginitis is a common medical problem in women that is associated with substantial discomfort, significant morbidity, and hence, frequent medical visits. These infections if not treated or ignored could debilitate the patient and could become a source of infection for the neonates, especially in case of women belonging to the childbearing age.[11]

Vaginal flora of adult females contains Lactobacilli which helps in maintaining the vaginal pH and thereby prevent the overgrowth of potential pathogens, thus reducing the frequency of infections. However, antibiotics like broad-spectrum can kill or suppress helpful bacteria in the genital tract, allowing resistant organisms to grow unchecked.[12] AV is a syndrome due to the alteration of the vaginal biota with different bacterial, clinical, and immunological characteristics with respect to the classic form of vaginitis. From a clinical point of view, the infection is characterized by the presence of yellowish, bad-smelling secretions, redness, itching, and congestion of the vaginal mucosa and different levels of dyspareunia, toxic leucocytes, and parabasal epitheliocytes, negative KOH test, and raised vaginal pH. AV is one of those diseases that is prevalently transmitted by sexual contact and if it is not diagnosed and treated early, during pregnancy can place the health of both the mother and the fetus at risk as it is associated with preterm birth, pPROM, and chorioamnionitis. It is therefore very important diagnosing it early and treating with a correct pharmacological therapy.[13] Therefore, this study was designed to assess the frequency of various aerobic pathogens in vaginal infections in females in the childbearing age group.

The prevalence of AV in our study is 58.5% which is found to be higher than that of a study done by Fan *et al.,* who reported the prevalence rate of 23.74%[14] and Sangeetha *et al.,* who reported the prevalence of 20.8%.[9] Even higher prevalence of AV was observed by Cheng *et al.* and Razzak *et al.*, i.e. 80 % and 95.45%, respectively.[15,16]

The highest frequency of infection (65.27%) was observed at 25-30 years followed by 31-35 years of age group with a frequency of 60.01%. Mumtaz *et al.* in 2008 reported the

Table 3a: Antimicrobial resistance pattern in Gram-positive isolates

Antimicrobial	*S. aureus* (*n*=59)	*E. faecalis* (*n*=30)	Coagulase-negative *Staphylococcus* (*n*=23)
Ampicillin (10 mcg) (%)	71.9	60.0	NT
Azithromycin (15 mcg) (%)	47.3	NT	7.8
Amikacin (30 mcg) (%)	40.3	46.6	0
Gentamicin (10 mcg) (%)	61.4	10.0	0
Ciprofloxacin (5 mcg) (%)	57.8	50.0	0
Amoxicillin-clavulanate (20 mcg/10 mcg) (%)	10.5	6.6	0
VAR (30 mcg) (%)	0	3.3	0
Linezolid (30 mcg) (%)	0	0	0

S. aureus: Staphylococcus aureus, E. faecalis: Enterococcus faecalis, VAR: Vancomycin

Table 3b: Antimicrobial resistance patterns of Gram-negative isolates

Antimicrobial	*E. coli* (*n*=89)	*K. pneumoniae* (*n*=84)	*Pseudomonas* species (*n*=9)	*Acinetobacter* species (*n*=16)	*Proteus* species (*n*=1)	*Citrobacter* species (*n*=3)
Ciprofloxacin (5 mcg) (%)	64.0	61.9	44.4	75.0	100	66.6
Amikacin (30 mcg) (%)	32.5	44.0	22.2	62.0	100	100
Gentamicin (10 mcg) (%)	47.1	51.1	33.3	68.5	100	100
Ceftriaxone (30 mcg) (%)	56.1	65.4	44.4	50.0	100	33.3
Ceftazidime (30 mcg) (%)	43.9	45.2	33.1	25.0	100	33.3
Sulbactam-Ceftazidime (30/10 mcg)	3.3	7.1	11.1	12.5	0	0
Piperacillin-Tazobactam (100 mcg/10 mcg) (%)	4.4	4.7	11.1	0	0	0
Imipenem (10 mcg) (%)	1.12	1.19	0	0	0	0

E.coli: Escherichia coli, K. pneumoniae: Klebsiella pneumoniae

highest incidence of vaginal infections among young, sexually active females, at the two age groups, i.e., 31-40 years (39.5%), followed by 41-50 years (35.8%).[17] Another study by Khan and Khan (2004) showed that these infections are common at the age groups of 15-30 years followed by 31-40 years.[11] Although adult women have lactobacillus in their vaginal flora which serves as a check for other pathogenic organisms, other activities of these women like sexual activities and indiscriminate the use of antibiotics can predispose them to vaginal infections.

E. coli (24.92%) and *Klebsiella pneumoniae* (23.50%) were the most common aerobes isolated from the samples followed by *S. aureus*. In a study by Mumtaz *et al*.,[17] *S. aureus* (46.07%) was the most prevalent isolated pathogen. Tansarli *et al*. and Zarbo *et al*. also reported a high prevalence of *S. aureus* 41.7% and 27.9%, respectively.[13,18] In another study by Tariq *et al.,* the common isolates were *Enterococcus* spp. (14.7%), *E. coli* (10.2%), and beta-hemolytic *Streptococcus* spp. (7.3%).[19] Donders also stated the causes of AV as *E. coli*, *Enterococci*, *Staphylococcus* spp., and*E. coli* are cited as one of the most common causes of this vaginitis.[20]

In our study, the prevalence of AV in pregnant females was slightly lower (29.30%) than nonpregnant females (72.80%). The prevalence in pregnant in a study by Sangeetha *et al*.[8] was 7.14%. Donders *et al*.[20] in 2009 studied 759 pregnant women among which 8.3% had coccoid AV flora. The low incidence of AV among pregnant women in our study may be due to the fact that pregnancy is a period in which the vaginal microbiota conditioned by high estrogen levels has a good supply of glycogen and a high percentage of lactobacillary flora which significantly reduces the multiplication of pathogenic organisms, more due to production of defence factors by Lactobacilli.[13]

In this study, common Gram-negative isolates *E. coli* and *K. pneumoniae* showed more resistance to ceftriaxone, ceftazidime, amikacin, and gentamicin and showed high sensitivity to beta-lactam/beta-lactam inhibitor combination and carbapenems (Table 3b). Study by Shamim *et al*. showed that the most effective chemotherapeutic agents against Gram-negative rods (*E. coli* and *K. pneumoniae*) were imipenem (96.0%, 100%), piperacillin/tazobactam (92.1%, 95.8%), whereas the antimicrobials with least affectivity against both of them were those belonging to the groups of penicillins, sulfonamides, and tetracyclines.[17] In the present study, the Gram-positive isolates showed maximum resistance to ampicillin, aminoglycosides, and ciprofloxacin and high sensitivity to linezolid, VAR, and amoxicillin-clavulanate [Table 3a]. A similar study by Nahar *et al*., the Gram-positive organisms showed more resistance to penicillin and ampicillin. About 39.1% of the *S. aureus* isolates were resistant to penicillin.[21]

AV is a frequent infection of the lower genital system, and it does not differentiate from other vaginal infections by its clinical characteristics. In high percentage, it is associated with other infections. It is very important to pay attention to the presence of AV as mixed infection or special entity when diagnosing vaginitis, especially in pregnancy. Therapeutic treatment of AV differentiates from other types of vaginitis and wrong diagnose can lead to wrong treatment and complications.[22]

CONCLUSION

Our study concludes that aerobic vaginitis is a common female genital tract infection and most prevalent sexually active females whose vaginal ecosystem demonstrates an abnormal status of vaginal flora. The high prevalence of gynecological infections demands that the patients with gynecological symptoms are investigated thoroughly, and culture must invariably be done. The antibiotics showing good sensitivity must be used to eradicate the infection but with care to not destroy the normal vaginal flora. Hence, there is a need for an effective antimicrobial policy.

REFERENCES

1. Donders GG, Vereecken A, Bosmans E, Dekeersmaecker A, Salembier G, Spitz B. Definition of a type of abnormal vaginal flora that is distinct from bacterial vaginosis: Aerobic vaginitis. BJOG 2002;109:34-43.
2. Kent HL. Epidemiology of vaginitis. Am J Obstet Gynecol 1991;165:1168-76.
3. Dan M, Kaneti N, Levin D, Poch F, Samra Z. Vaginitis in a gynecologic practice in Israel: Causes and risk factors. Isr Med Assoc J 2003;5:629-32.
4. Syed TS, Braverman PK. Vaginitis in adolescents. Adolesc Med Clin 2004;15:235-51.
5. McDonald HM, O'Loughlin JA, Jolley PT, Vigneswaran R, McDonald PJ. Changes in vaginal flora during pregnancy and association with preterm birth. J Infect Dis 1994;170:724-8.
6. Hay PE, Lamont RF, Taylor-Robinson D, Morgan DJ, Ison C, Pearson J. Abnormal bacterial colonisation of the genital tract and subsequent preterm delivery and late miscarriage. BMJ 1994;308:295-8.
7. Rosenstein IJ, Morgan DJ, Sheehan M, Lamont RF, Taylor-Robinson D. Effect of Topical Clindamycin on Bacterial Vaginosis During Pregnancy [Abstract]. Aspen, Colorado: Second International Meeting on Bacterial Vaginosis; 1998. p. 17-9.
8. Sangeetha KT, Saroj G, Vasudha CL. A study of aerobic bacterial pathogens associated with vaginitis in reproductive age group women (15-45 years) and their sensitivity pattern. Int J Res Med Sci 2015;3:2268-73.
9. Colle JG, Duguid JP, Fraser AG, Marmion BP, Simmons A. Laboratory strategy in the diagnosis of infective syndromes. In: Collee JG, Fraser AG, Marmion BP, Simmons A, editors. Mackie and Mc Cartney Practical Medical Microbiology. 14th ed. Singapore: Churchill Livingstone; 2006. p. 53-94.
10. CLSI - Clinical and Laboratory Standards Institute. Performance Standards for Antimicrobial Susceptibility Testing. 27th Informational Supplement. Wayne, PA, USA: CLSI; 2017; M100 S27.
11. Khan I, Khan UA. A hospital based study of frequency of aerobic pathogens in vaginal infections. J Rawal Med Coll 2004;29:22-5.
12. Lowy FD. *Staphylococcus aureus* infections. N Engl J Med 1998;339:520-32.
13. Zarbo G, Coco L, Leanza V, Genovese F, Leanza G, D'Agati A, *et al.* Aerobic vaginitis during pregnancy. Res Obstet Gynecol 2013;2:7-11.
14. Fan A, Yue Y, Geng N, Zhang H, Wang Y, Xue F. Aerobic vaginitis and mixed infections: Comparison of clinical and laboratory findings. Arch Gynecol Obstet 2013;287:329-35.
15. Cheng L, Wang JY. The vaginal micro-flora of aerobic vaginitis and bacterial vaginosis. Zhongguo Wei Shengt Axixue Za Zhi 2009;21:1107-9.
16. Razzak MS, Al-Charrakh AH, Al-Greitty BH. Relationship between lactobacilli and opportunistic bacterial pathogens associated with vaginitis. N Am J Med Sci 2011;3:185-92.
17. Mumtaz S, Ahmad M, Aftab I, Akhtar N, ul Hassan M, Hamid A. Aerobic vaginal pathogens and their sensitivity pattern. J Ayub Med Coll Abbottabad 2008;20:113-7.
18. Tansarli GS, Kostaras EK, Athanasiou S, Falagas ME. Prevalence and treatment of aerobic vaginitis among non-pregnant women: Evaluation of the evidence for an underestimated clinical entity. Eur J Clin Microbiol Infect Dis 2013;32:977-84.
19. Tariq N, Jaffery T, Ayub R, Alam AY, Javid MH, Shafique S. Frequency and antimicrobial susceptibility of aerobic bacterial vaginal isolates. J Coll Physicians Surg Pak 2006;16:196-9.
20. Donders GG, Van Calsteren K, Bellen G, Reybrouck R, Van den Bosch T, Riphagen I, *et al*. Predictive value for preterm birth of abnormal vaginal flora, bacterial vaginosis and aerobic vaginitis during the first trimester of pregnancy. BJOG 2009;116:1315-24.
21. Nahar D, Soni G, Chand AE, Mourya S. Bacterial etiology and their antibiogram in aerobic vaginitis patients at tertiary care hospital, Kota, Rajasthan. Int J Sci Stud 2016;4:103-7.
22. Jahic M, Mulavdic M, Nurkic J, Jahic E, Nurkic M. Clinical characteristics of aerobic vaginitis and its association to vaginal candidiasis, trichomonas vaginitis and bacterial vaginosis. Med Arch 2013;67:428-30.

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