

Comparative Evaluation of Gram Stain and Conventional Pap Stain in Diagnosing Bacterial Vaginosis and Candidiasis: A Cross-Sectional Study

Dr. Santosh Kumar Mondal¹, Dr. Bibhas Saha Dalal², Dr. Deepika Pandey³,
Ashish Kumar Yadav⁴, Shifana T⁵, Dr. Subrat Panda⁶

¹Professor & HOD, Department of Pathology, AIIMS, Kalyani, India

²Assistant Professor, Department of Pathology, AIIMS, Kalyani, India

³Assistant Professor, Department of Pathology, Dr. Sonelal Patel ASMC, Uttar Pradesh, India

⁴Assistant Professor, Centre of Biostatistics IMS, BHU, Uttar Pradesh, India

⁵MBBS student, AIIMS, Kalyani, India

⁶Professor & HOD, Department Obstetrics and Gynaecology, AIIMS, Kalyani, India

Corresponding Author: Dr. Bibhas Saha Dalal, e-mail id: bibhas.patho@aiimskalyani.edu.in

DOI: <https://doi.org/10.52403/ijhsr.20231026>

ABSTRACT

Background: Genital tract infections like bacterial vaginosis (BV) and vulvovaginal candidiasis are a significant global health concern, impacting reproductive and child health. The conventional Pap smear, though effective for cervical cancer screening, has conflicting evidence regarding its accuracy in diagnosing BV.

Methods and Materials: A comparative, cross-sectional study was conducted on 518 female patients aged 21 to 65 years attending a tertiary care hospital's Obstetrics & Gynaecology Outpatient Department. Cervicovaginal smears were collected from each patient and submitted for Gram staining and conventional Pap staining. The slides were independently evaluated by two blinded pathologists, and a third pathologist was consulted in cases of discordant results. The final diagnosis was always offered with 2 out of 3 majority. The presence of BV and candidiasis were assessed using established criteria.

Results: Out of the 518 cases, BV was diagnosed in 32.4% by Gram stain and 24.5% by Pap stain. The sensitivity and specificity of Gram stain were 81.08% and 94.59%, respectively, while for Pap stain, they were 57.30% and 93.69%, respectively. Positive predictive values were 89.29% for Gram stain and 83.46% for Pap stain in diagnosing BV. However, there was no significant difference between the two staining methods in diagnosing vulvovaginal candidiasis.

Conclusion: Gram stain demonstrated higher sensitivity and positive predictive value than Pap stain in diagnosing BV. While Pap smear is widely used for cervical cancer screening, it may not be as reliable in diagnosing BV due to its lower sensitivity and lack of a standardized scoring system. The Gram stain, on the other hand, is readily available, cost-effective, and easy to perform, making it a valuable tool in resource-limited settings to aid in the diagnosis and management of BV.

Keywords: Gram stain, Pap stain, bacterial vaginosis, candidiasis

INTRODUCTION

Lower Reproductive tract infections (RTIs) in women are a common clinical issue and a major cause of morbidity. Infections such as bacterial vaginosis (BV) and vulvovaginal candidiasis remain the most frequent types

of RTIs worldwide.^[1] These infections are reported to be a significant health burden, which have a substantial impact on reproductive and child health globally and in India.^[2,3] Similarly, cervical cancer is also an increasing health problem, and a

leading cause of mortality in women, particularly in developing countries.^[4]

Although Papanicolaou (Pap) smear is an established screening test for the detection of cervical precancerous lesions and cancerous lesions, but there is limited evidence from India regarding its accuracy in detecting BV and other infective organisms.^[2] Cervical Gram stain smears taken during gynaecological examination are an inexpensive and relatively easy procedure that helps in identifying different infective organisms associated with lower RTIs in women.^[5]

Bacterial vaginosis is characterized by an increased vaginal pH, milky creamy discharge, and an amine or fishy odour. Microbiologically, BV is characterized by a shift in vaginal flora from the dominant flora of *Lactobacillus* spp. to a mixed vaginal flora that includes *Gardnerella vaginalis*, *Bacteroides* spp., *Mobiluncus* spp., and *Mycoplasma hominis*.^[6] BV can be diagnosed using two different methods: Amsel's criteria and Nugent's scoring.^[7,8]

Cultures which are the gold standard in most other infections, has low sensitivity and specificity in diagnosing BV due to its complex polymicrobial nature.^[9-12]

Vulvovaginal candidiasis is an opportunistic mucosal mycosis that is quite prevalent in female patients complaining of clumpy white vaginal discharge. Gram stain can help identify fungal elements quickly.^[13]

In this study we tried to compare Amsel's clinical criteria, Nugent's scoring system, Gram stain and routine conventional Pap smears in diagnosing infections of female genital tract.

MATERIALS & METHODS

Our study is a comparative, cross-sectional study conducted on 518 female patients aged between 21 and 65 years who presented to the Obstetrics & Gynaecology Outpatient Department in a tertiary care hospital. Cervical smears from both ectocervix and endocervix were collected by a trained nurse using a standard protocol with cervical cytology brushes and wooden

spatula. Patients who were pregnant, postpartum, menstruating, or have undergone cervical surgery or radiotherapy were excluded.

Clinical information like age, menstrual history, parity and clinical symptoms were recorded. BV was suspected in patients based on Amsel clinical criteria. Amsel and colleagues introduced the clinical criteria in 1983 for the diagnosis of BV. They suggested that if at least three of the four criteria are present, it is likely that BV is present. The four criteria are: a vaginal pH of greater than 4.5, the presence of clue cells on a saline wet mount, the release of a fishy odour when 10% potassium hydroxide (KOH) is added to a drop of vaginal discharge, and the presence of a characteristic, thin, and homogeneous vaginal discharge.^[8]

Three smears were taken from each patient. Two smears were collected from the ectocervix and vagina, each of which were sent for Gram stain (Slide 1) and Pap stain (Slide 2). The third smear was collected from endo-cervix (Slide 3), to detect epithelial cell abnormalities. The smears from the ectocervix and vagina i.e., Slides 1 and 2 were only included for the present study as the microbial load in vagina and ectocervix is far more than endocervix.^[14]

The smears for gram staining were air-dried and the smears for Pap staining were fixed with 95% ethanol. All the unstained smears were sent to Pathology Laboratory for staining and interpretation. Gram stain and conventional Pap stain were performed by trained laboratory technicians using standard staining protocols.

Microscopic evaluation:

Both the Gram-stained slide and the Pap-stained slide from each patient were interpreted by two separate Pathologists (Pathologist A, Pathologist B), both being blinded of each other's findings. The Gram-stained slide was numbered differently from the Pap-stained slide to avoid biasness. The stained slides were evaluated and assessed for the quality of the smear, the presence of

inflammatory cells, the presence of infective organisms and the presence of epithelial cells with abnormal morphology.

On Gram-stained smears: The Nugent scoring system was applied by each pathologist, based on the observation of bacterial morphology in a Gram-stained smear under a microscope [Table 1]. Morphotypes are scored as the average number seen per oil immersion field. Less weight is given to curved gram-variable bacilli. The final Nugent score is obtained by adding the scores for each type of bacteria together (Total score = Lactobacillus morphotypes + Gardnerella vaginalis morphotypes + Mobiluncus spp. morphotypes). A score of 0-3 is considered normal, 4-6 indicates intermediate, and 7-10 indicates bacterial vaginosis. [6]

On Pap-stained smears: The smears were evaluated under microscope by both the Pathologists and reported based on the latest The Bethesda System (TBS) 2014 guidelines.

The findings for the Gram stain and the Pap stain by each Pathologist was recorded separately. If there was mutual agreement between the two pathologists, the diagnosis was offered. But, only in cases where there was disagreement between Pathologist A and Pathologist B, an opinion from a third Pathologist was sought for. The final diagnosis was always offered based on decision by the majority, 2 out of 3 pathologists. For the purpose of the present study, only data pertaining to BV and candidiasis have been selected.

Table 1: The Nugent's scoring (0 to 10) of Gram-stained smears [6,7]

Score	Large gram-positive rods (Lactobacillus morphotypes)	Small gram-negative to variable coccobacilli (Gardnerella vaginalis morphotypes)	Curved gram- variable bacilli (Mobiluncus spp. morphotypes)
0	4+	0	0
1	3+	1+	1+ or 2+
2	2+	2+	3+ or 4+
3	1+	3+	
4	0	4+	

Note: 0, No morphotypes present; 1+, <1 morphotype present; 2+, 1 to 4 morphotypes present; 3+, 5 to 30 morphotypes present; 4+, 30 or more morphotypes present.

STATISTICAL ANALYSIS

Statistical analysis was performed using Microsoft office excel 2021 and SPSS version 28.

RESULT

The mean age of the patients was 32 years (range 21 – 65 years). Out of 518 cases 220 (42.5%) women were suffering from vaginal discharge, 155 (30%) had pain lower abdomen and 35 (6.8%) complained of itching in genital region. Vaginal discharge was greyish in 45% of cases, clear to white in 22%, reddish in 20% and yellow-green in 13% cases. Bad smell was observed in 56% of the patients. BV was found by Amsel's criteria in 185 (35.7%) of the 518 cases. Cytologic evaluation related to each case was performed, without referring to any data obtained via Amsel's criteria.

With Gram stain, Pathologist A diagnosed Bacterial vaginosis (BV) in 175 (33.8%) of

the 518 cases and by applying Nugent scoring system his average score was 8. While Pathologist B diagnosed BV in 162 (31.3%) of the 518 cases and by applying Nugent scoring system his average score was also 8. In cases of disagreement, after considering opinion of the third Pathologist (by the majority, 2 out of 3 pathologists), BV was finally diagnosed in 168 (32.4%) cases and the average Nugent score remained 8. The most common organism morphotype recorded was small gram-negative to variable coccobacilli (Gardnerella vaginalis morphotypes) followed by curved gram-variable bacilli (Mobiluncus spp. morphotypes).

Similarly, Pathologist A and B diagnosed fungal organisms morphologically consistent with Candida species (spp.) in 32 (6.1%) and in 36 (6.9%) cases respectively. Both pseudohyphae and budding yeast forms of Candida species were noted.

Considering the opinion of all the three Pathologists (by the majority, 2 out of 3 pathologists), gram positive fungal yeast form suggestive of *Candida* species was finally diagnosed in 35 (6.8%) cases of the 518 cases. [Table 2].

With Pap stain, Pathologist A & B respectively diagnosed shift in vaginal flora suggestive of BV in 130 (25%) and 122 (23.6%) of the 500 cases. Fungal organisms

morphologically consistent with *Candida* species was diagnosed by Pathologist A & B respectively in 28 (5.4%) and 26 (5%) cases respectively. Again, after considering the opinion of all the three Pathologists, BV and fungal organisms morphologically consistent with *Candida* species was finally diagnosed in 127 (24.5%) and 28 (5.4%) cases respectively. [Table 2].

Table 2: Distribution of diagnosed cases by Pathologist A, B. The final diagnosis C was decided (by the majority, 2 out of 3 pathologists)

		A	B	C
Gram stain	BV	33.8%	31.3%	32.4%
	<i>Candida</i> spp.	6.1%	6.9%	6.8%
	Gram-positive cocci	24.7%	24%	24.1%
Pap stain	BV	25%	23.6%	24.5%
	<i>Candida</i> spp.	5.4%	5%	5.4%

Considering Amsel's criteria as reference, out of the 185 cases of BV found by Amsel's criteria, BV was finally diagnosed in 150 cases and the rest 18 cases were false positive [Table 3,4]. Similarly, out of the

185 cases of BV found by Amsel's criteria, with Pap stain BV was finally diagnosed in 106 cases and the remaining 21 cases were false positive [Table 3,4].

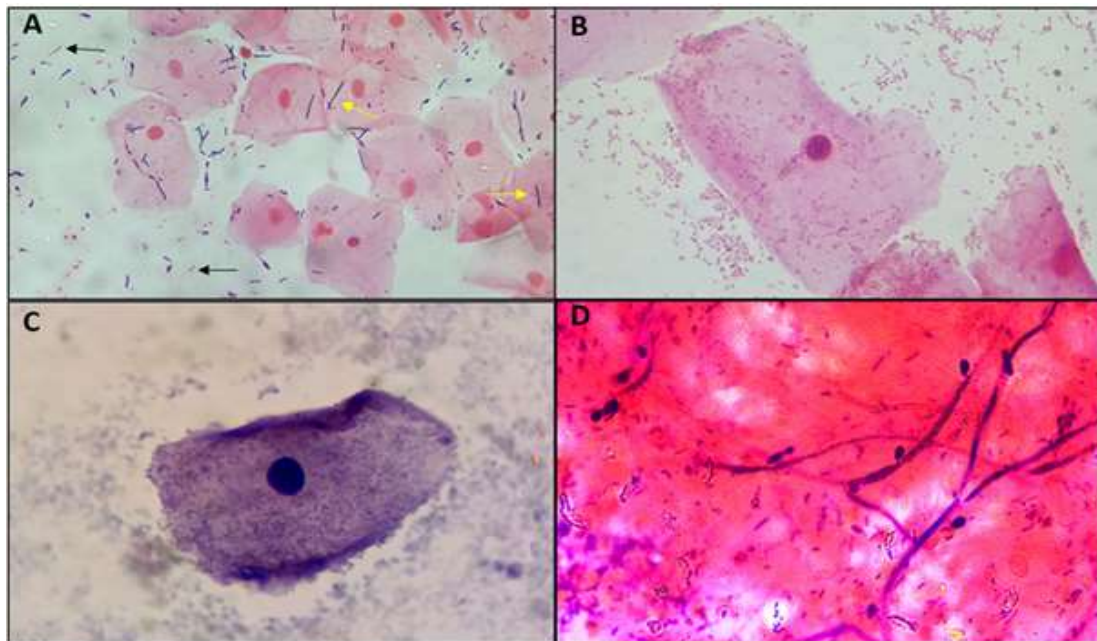


Figure 1: A. 3+ *Lactobacillus* morphotypes (yellow arrow), 3+ *Gardnerella* spp. Morphotypes (black arrow), Total score 1+ 3= 4; Gram-stain 100x, B. 0 *Lactobacillus* morphotypes, 4+ *Gardnerella* spp. Morphotypes, Total score: 4+ 4= 8; Gram-stain 100x, C. Clue cell with attached cocco-bacilli; Pap-stain 100x, D. Pseudohyphae and budding yeast form of *Candida* species; Gram-stain 40x

Table 3: Distribution of BV positive cases according to diagnosis methods

Diagnostic Method	BV +ve cases (185 according to Amsel)
Gram stain	
True (+) cases	150
False (-) cases	35
Pap stain	
True (+) cases	106
False (-) cases	79

Table 4: Distribution of BV negative cases according to diagnosis methods

Diagnostic Method	BV -ve cases (333 according to Amsel)
Gram stain	
True (-) cases	315
False (+) cases	18
Pap stain	
True (-) cases	312
False (+) cases	21

Sensitivity and specificity of diagnosing BV were 81.08 % and 94.59 % respectively with Gram stain. With Pap stain, sensitivity and specificity were at 57.30 % and 93.69 % respectively. Positive predictive values (PPV) were determined as 89.29 % for the Gram stain method and 83.46 % for the Pap stain method.

To determine whether Gram stain is better than Pap stain in diagnosing Bacterial vaginosis (BV) values from Table 2 were put for statistical analysis using Z test for proportion. On comparison of Gram stain versus Pap stain all the three pathologists obtained significant differences in diagnosing BV. The pathologist A observed the maximum difference of 8.8% having a significant p-value of 0.0019. The pathologist B & C obtained a difference of 7.7% and 7.9% which was significant at a p-value < 0.005. However, there was no significant difference obtained for diagnosing Candida spp. by Gram stain and Pap stain. A maximum difference of 1.9% (p value=0.1964) was observed by the pathologist B followed by pathologist C (1.4 %) and A (0.7%). Therefore, it can be concluded that though Gram stain is better than Pap stain in diagnosing BV but it is not significantly better in diagnosing Candida spp.

DISCUSSION

Bacterial vaginosis (BV) is the most common cause for vaginitis and occurs due to an imbalance in the vaginal ecosystem, leading to an overgrowth of both anaerobic and aerobic microorganisms.^[15] It causes foul-smelling fishy vaginal discharge and patients frequently experience itching in the perineal area.^[16] Though such symptoms can give a clue about BV but still microscopical examination with Gram stained or Pap stained cervicovaginal smears is to be done to avoid mistaken diagnosis. Moreover, a significant number of women with BV are reported to be asymptomatic and are only diagnosed on smears.^[16,17]

In the present study, the mean age of the patients was 32 years (range 21–65 years), which is similar to the findings of the study done by Vardar E et al,^[15] where the mean age of subjects was 31.7 years (range 18–51 years). In this study, the most common symptom that the patients presented with was vaginal discharge of greyish color, which is similar to the studies done by Vardar E et al,^[15] and Klebanoff MA et al.^[17] Bad odour was reported in 56% of the cases, which is similar to the cases (58%) observed by Klebanoff MA et al,^[17] while Vardar E and his colleagues reported bad odour in 96% cases.

Sensitivity Specificity and Positive Predictive values (PPV) of diagnosing BV in our study have been compared to the findings of similar studies [Table 5].

Table 5: Comparison of present study results with similar studies on BV in the past

Study	Sensitivity %		Specificity %		PPV %	
	Gram stain	Pap stain	Gram stain	Pap stain	Gram stain	Pap stain
Present study	81.08	57.30	94.59	93.69	89.29	83.46
Vardar E and colleagues ^[15]	97	93	94	94	88	86
Platz-Christensen and colleagues ^[18]	100	88	97	97	94	97

According to Davis et al,^[19] when comparing the Gram stain with Pap stain

results, the sensitivity of the Pap stain was 55%, and its specificity was 98%. Lamont

and colleagues [20] reported that when Pap stain cytology was conducted by multiple cytotechnicians, it showed a sensitivity of 80.7% and a specificity of 90.7%. Tokyol C et al [21] also concluded that the Pap smear is not highly sensitive enough for screening bacterial vaginosis. Citing the above findings, it can be concluded that Pap smear has a lower sensitivity compared to Gram stain in diagnosing Bacterial vaginosis. These findings are similar to the findings of the present study.

However, Pap stain showed relatively high specificity in our study which is in correlation with all of the earlier cited studies. Hence, it can be stated that the Pap smear test is better at correctly identifying individuals without BV (true negatives) but may miss many cases of BV (false negatives). Clinicians should be aware of these limitations and consider alternative diagnostic approaches when necessary to ensure accurate BV diagnosis.

Top of Form

In the study by Anand KV et al, [22] they also commented that though Pap smear is an established screening tool to detect epithelial cell abnormalities of the cervix, but Amsel criteria and Nugent score are the two most commonly evaluated gold standard methods to diagnose BV infection. The reason behind the Pap smear's low sensitivity in diagnosing BV infection could be attributed to its reliance on mostly cervical swabs instead of vaginal swabs for detecting BV. BV is predominantly a vaginal infection, and evaluating only cervical samples, specially endocervical smears, may not accurately reflect the microbial changes occurring in the vagina during BV. Moreover, the Pap smear does not have a standardized scoring system like the Nugent score, which is necessary to quantify the number of bacteria and lactobacilli observed per high-power field (HPF), a prerequisite for identifying BV.

It is also important to note that the criteria to diagnose BV infection by Pap smear includes clue cells which can be confused with lactobacilli covered pseudo clue cells

causing false positive diagnosis of BV. Finally, in absence of inflammatory cells, "shift of vaginal flora suggestive of BV" and not "vaginitis" may be accounted for normal/intermediate vaginal flora that might not even result in clinical infection. [21-23]

Therefore, it can be inferred that using Pap stain of cervicovaginal smears for diagnosing BV is probably less dependable compared to the results obtained through Gram staining. Gram stain is readily available, easy to perform, cost effective and takes very less time (5-7 minutes) to perform. Moreover, Nugent scoring can easily be performed in cases of clinically suspected BV, to give an idea about the type of causative organism associated, which is not possible in routine Pap smears. We also observed that though Gram stain is better than Pap stain in diagnosing BV but it is not significantly better in diagnosing Candida spp.

In developing countries, with resource-limited settings, where BV is quite prevalent due to poor socioeconomic conditions and unhygienic practices, a simple Gram stain along with the routine Pap stain screening for cervicovaginal smears might be a more practical and accessible approach to aid in the diagnosis and management of BV resource-limited settings.

CONCLUSION

In conclusion, this study sheds light on the diagnostic efficacy of Gram stain versus Pap stain in identifying lower reproductive tract infections (RTIs), particularly Bacterial Vaginosis (BV) and Candidiasis, in a cohort of 518 female patients. The findings underscore the significant prevalence of BV in this population, as diagnosed by Amsel's criteria, and highlight the importance of accurate and accessible diagnostic methods for RTIs.

The study demonstrates that Gram stain coupled with the Nugent scoring system, offers a practical, cost-effective, rapid and dependable approach for diagnosing BV with superior sensitivity compared to Pap stain. This method holds particular promise

in resource-limited settings, where BV is prevalent due to poor socioeconomic conditions and hygiene practices.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: None

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Write relevant, correct and complete references here. Diadihou M, Ba Diallo A, Barry MS, Alavo SC, Mall I, Gassama O, Ndiaye Guèye MD, Ndao Fall A, Gawa E, Gaye Diallo A, Moreau JC. Prevalence and Risk Factors of Lower Reproductive Tract Infections in Symptomatic Women in Dakar, Senegal. *Infect Dis (Auckl)*. 2019 May 31; 12:1178633719851825.
2. Anand KV, Pimple SA, Mishra GA, Sahare RV, Pathuthara S, Deodhar KK, Shastri SS. Reliability of conventional Papanicolaou smear in diagnosing bacterial vaginosis among women with clinical genital infection. *South Asian J Cancer*. 2020 Jan-Mar; 9(1):13-16.
3. Jayapalan S, Bindu RS. Papanicolaou smear: A diagnostic aid in sexually transmitted infections. *Indian J Sex Transm Dis AIDS*. 2020 Jul-Dec; 41(2):143-148.
4. Sachan PL, Singh M, Patel ML, Sachan R. A Study on Cervical Cancer Screening Using Pap Smear Test and Clinical Correlation. *Asia Pac J Oncol Nurs*. 2018 Jul-Sep; 5(3):337-341.
5. Myziuk L, Romanowski B, Brown M. Endocervical Gram stain smears and their usefulness in the diagnosis of Chlamydia trachomatis. *Sex Transm Infect*. 2001 Apr; 77(2):103-6.
6. Nugent RP, Krohn MA, Hillier SL. Reliability of diagnosing bacterial vaginosis is improved by a standardized method of gram stain interpretation. *J Clin Microbiol*. 1991 Feb; 29(2):297-301.
7. Mala R, Sood S, Kapil A, Gupta S, Singh N. Comparison of Amsel's criteria with low and high Nugent's scores for the diagnosis of bacterial vaginosis. *Indian J Sex Transm Dis AIDS*. 2022 Jan-Jun; 43(1):56-58.
8. Sha BE, Chen HY, Wang QJ, Zariffard MR, Cohen MH, Spear GT. Utility of Amsel criteria, Nugent score, and quantitative PCR for Gardnerella vaginalis, Mycoplasma hominis, and Lactobacillus spp. for diagnosis of bacterial vaginosis in human immunodeficiency virus-infected women. *J Clin Microbiol*. 2005 Sep; 43(9):4607-12.
9. Money D. The laboratory diagnosis of bacterial vaginosis. *Can J Infect Dis Med Microbiol*. 2005 Mar; 16(2):77-9.
10. Hillier SL. Diagnostic microbiology of Bacterial vaginosis. *Am J Obstet Gynecol* 1993; 169:455-9.
11. Krohn MA, Hillier SL, Eschenbach DA. Comparison of methods for diagnosing Bacterial vaginosis among pregnant women. *J Clin Microbiol* 1989; 27:1266-71.
12. Spiegel CA. Bacterial vaginosis. *Rev Med Micro* 2002; 13:43-51.
13. Omar AA. Gram stain versus culture in the diagnosis of vulvovaginal candidiasis. *East Mediterr Health J*. 2001 Nov; 7(6):925-34.
14. Barrios De Tomasi J, Opata MM, Mowa CN. Immunity in the Cervix: Interphase between Immune and Cervical Epithelial Cells. *J Immunol Res*. 2019 Apr 17; 2019:7693183.
15. Vardar E, Maral I, Inal M, Ozgüder O, Tasli F, Postaci H. Comparison of Gram stain and Pap smear procedures in the diagnosis of bacterial vaginosis. *Infect Dis Obstet Gynecol*. 2002; 10(4):203-7.
16. Khedkar R, Pajai S. Bacterial Vaginosis: A Comprehensive Narrative on the Etiology, Clinical Features, and Management Approach. *Cureus*. 2022 Nov 10; 14(11):e31314.
17. Klebanoff MA, Schwebke JR, Zhang J, Nansel TR, Yu KF, Andrews WW. Vulvovaginal symptoms in women with bacterial vaginosis. *Obstet Gynecol*. 2004 Aug; 104(2):267-72.
18. Platz-Christensen JJ, Larsson PG, Sundstrom E, Wiquist N. Detection of bacterial vaginosis in wet mount, Papanicolaou-stained vaginal smears and in Gram-stained smears. *Acta Obstet Gynecol Scand* 1995; 74:67-70.
19. Davis JD, Connor EE, Clark P, et al. Correlation between cytologic results and Gram stain as diagnostic tests for bacterial vaginosis. *Am J Obstet Gynecol* 1997; 177:532-5.
20. Lamont RF, Hudson EA, Hay PE, Morgan DJ, Modi V, Ison CA, Taylor-Robinson D. A comparison of the use of Papanicolaou-

- stained cervical cytological smears with Gram-stained vaginal smears for the diagnosis of bacterial vaginosis in early pregnancy. *Int J STD AIDS*. 1999 Feb; 10(2):93-7.
21. Tokyol C, Aktepe OC, Cevrioğlu AS, Altindiş M, Dilek FH. Bacterial vaginosis: comparison of Pap smear and microbiological test results. *Mod Pathol*. 2004 Jul; 17(7):857-60.
22. Anand KV, Pimple SA, Mishra GA, Sahare RV, Pathuthara S, Deodhar KK, Shastri SS. Reliability of conventional Papanicolaou smear in diagnosing bacterial vaginosis among women with clinical genital infection. *South Asian J Cancer*. 2020 Jan-Mar; 9(1):13-16.
23. Swidsinski A, Loening-Baucke V, Swidsinski S, Sobel JD, Dörffel Y, Guschin A. Clue Cells and Pseudo Clue Cells in Different Morphotypes of Bacterial Vaginosis. *Front Cell Infect Microbiol*. 2022 May 27; 12:905739.

How to cite this article: Santosh Kumar Mondal, Bibhas Saha Dalal, Deepika Pandey, Ashish Kumar Yadav, Shifana T, Subrat Panda. Comparative evaluation of gram stain and conventional pap stain in diagnosing bacterial vaginosis and candidiasis: a cross-sectional study. *Int J Health Sci Res*. 2023; 13(10):194-201. DOI: [10.52403/ijhsr.20231026](https://doi.org/10.52403/ijhsr.20231026)
