The occurrence and comparative analysis of bacterial vaginosis and its association with urinary tract infections among pregnant women in a tertiary care hospital of Western Uttar Pradesh

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Summary

Background: Bacterial Vaginosis (BV) is the most prevalent etiology of vaginal discharge in women of reproductive age. It is characterized by a shift in the vaginal microbiota, where Lactobacillus species are diminished and replaced by a diverse array of anaerobic bacteria. BV is associated with adverse pregnancy outcomes, including preterm labor and low birth weight, as well as an increased susceptibility to Urinary Tract Infections (UTIs). As such, it represents a significant public health concern. The diagnosis of bacterial vaginosis is typically established through the application of Amsel's criteria and the Nugent scoring system.

The purpose of this research is to compare Amsel's criteria with Nugent's scoring system in order to assess the diagnostic utility of the former and to see the association between UTI and BV.

Materials and Methods: in a tertiary care hospital in North India, 200 pregnant females participated in a cross-sectional study. The result was classified based on both Nugent's and Amsel's criteria.

Results: of the 200 women, 35 (17.5%) met Amsel's criteria for BV positivity, whereas 42 (21%) met Nugent's grading criteria. The values for Amsel's criteria were as follows: sensitivity (80%), specificity (91.5%), Positive Predictive Value (PPV) (66.7%), and Negative Predictive Value (NPV) (95.6%). 40.4% of patients had BV concomitant with UTI. There is a significant association between BV and UTI ($p<0.05$).

Conclusions: in spite of its affordability and ease of use, Amsel's criteria are not always a valid tool to diagnose bacterial vaginosis. The gold standard for diagnosing BV is Nugent's criteria; however, it takes a lot of time and expertise. Amsel's criteria can be used to diagnose BV when lab equipment is unavailable, as in many underdeveloped nations. In our study, both the tests were able to diagnose BV, but the Nugent scoring system has higher sensitivity. A significant association was found between UTI and BV.

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Introduction

«Vaginitis» is a term that refers to inflammation of the vagina, typically marked by symptoms such as burning and itching of the vulva, accompanied by a watery discharge. The three most common forms of vaginitis include trichomoniasis, Vulvovaginal Candidiasis (VVC), and Bacterial Vaginosis (BV) [1].

Reports indicate that BV is one of the most prevalent forms of vaginosis among women of reproductive age. This clinical syndrome is characterized by a disruption in the vaginal flora, where the normal lactobacilli are replaced by a mixture of bacteria. This may include *Mobiluncus* spp., *Gardnerella vaginalis*, *Bacteroides* spp., *Mycoplasma hominis*, and various anaerobes from the genera Porphyromonas, Prevotella, and Peptostreptococcus [21].

It is more frequently observed in low-income countries compared to industrialized nations [8]. Extensive research reveals that BV can impact nearly 50% of pregnant women, in stark contrast to its prevalence of just 15% to 30% among non-pregnant women.

This significant disparity emphasizes the increased susceptibility of pregnant individuals to this condition, highlighting the need for heightened awareness and monitoring during pregnancy [9,11,18]. This clinical condition manifests with symptoms such as vaginal discharge, itching, and an unpleasant odor [25]. It is associated with several obstetric complications, highlighting the need for swift diagnosis and treatment. It also significantly heightens a woman's risk of Urinary Tract Infections (UTIs) [17]. Sexual activity is a key factor in the interplay between UTIs and BV [5,7].

Nugent *et al.*'s microscopic criteria and Amsel *et al.*'s clinical criteria are the primary methods for diagnosing BV. The Nugent scoring system is the gold standard due to its superior sensitivity and reliability. However, in developing countries like ours, access to necessary funding and laboratory equipment often presents substantial challenges [4,19].

While Amsel's criteria are affordable and user-friendly, they differ from the Nugent scoring system in terms of sensitivity and specificity. Given these considerations, this study seeks to explore the relationship between BV and UTIs, and to assess the diagnostic efficacy of Amsel's criteria in comparison to the Nugent scoring system.

Materials and Methods

Study design

With approval from the institutional ethics committee (174/2022-2023), a cross-sectional study was conducted involving 200 pregnant patients from the Department of Obstetrics and Gynaecology at a tertiary care hospital, in collaboration with the Microbiology Department of Lala Lajpat Rai Memorial Medical College, Uttar Pradesh. The study took place from January to April 2024, with patients selected based on established inclusion and exclusion criteria. Participants underwent medical history regarding their symptoms, treatment, and specific complaints (such as the color and quantity of discharge and any itching) before their gynecological examination. Women who were menstruating, HIV-positive, or had taken antibiotics or used topical vaginal creams within the seven days prior to the examination were excluded from the study.

Table 1. Amsel's criteria for Bacterial Vaginosis (BV) diagnosis.

S. no	Variable criteria	No. of positives (%)
1.	Vaginal discharge	145 (72.5%)
2.	Clue cells	51 (25.5%)
3.	Whiff test	70 (35%)
4.	pH >4.5	137 (68.5%)"

Table 2. Nugent's scoring for Bacterial Vaginosis (BV) diagnosis.

Gram stained bacterial cell score	No. of cases (%)
0-3	90 (45)
4-6	65 (32.5)
7-10	42 (21)

Methodology

Informed written consent was obtained from each participant before any pelvic examination. After a speculum inspection, two cotton swabs were used to collect vaginal discharge samples from the posterior fornix and lateral vaginal walls. These samples were analyzed for BV using both Nugent's score and Amsel's criteria. A participant was considered positive for BV if she met three of the following criteria: the presence of clue cells, a homogeneous vaginal discharge, a vaginal pH of at least 4.5, and a fishy odor after adding 10% KOH (whiff test). The Nugent score was determined using Gram staining techniques, focusing on distinct bacterial morphotypes: Prevotella/Bacteroides-like (small, Gram-negative bacilli), Gardnerella vaginalis-like (small, pleomorphic Gram-variable bacilli), and Mobiluncus-like (curved Gram-variable bacilli). At least five oil immersion fields were observed to calculate averages for each morphotype. Scores of 0–3 indicate normal vaginal flora (predominantly Lactobacillus), 4–6 represent intermediate flora, and 7–10 indicate BV, marked by increased G. vaginalis/Bacteroides, curved Gram-variable bacilli, and reduced Lactobacillus [19].

Statistical analysis

Frequencies and percentages, along with the chi-square test, were employed to analyze the collected data using SPSS version 25. The diagnostic efficacy of Amsel's criteria was assessed by calculating the negative predictive value, sensitivity, specificity, and positive predictive value.

Results

There were 200 antenatal patients in total in this study. The patients' largest proportion (38.5%) belonged to the 21-30 years age group. Vaginal discharge remained the most common complaint in 156 (78%) of the patients. The next most prevalent complaint, reported by 94 (47%) of patients, was lower abdomen discomfort. Additionally, 42 (21%) of the patients reported burning micturition, 36 (18%) reported foul smells, and 24 (12%) reported vaginal discomfort.

Of the 200 women, 35 cases were diagnosed with BV based on Amsel's criteria. The most common variable found was vaginal discharge 145 (72.5%), while the least common variable was the incidence of clue cells 51 (25.5%) in vaginal wet mounts (Table 1).

On the basis of the gold standard method *i.e.* 42 cases (21%) met Nugent's criteria and were classified as having BV (Table 2).

Amsel's criteria demonstrated a specificity of (85.1%), sensitivity of (53.1%), NPV of (90.5%), and PPV of (40.48%) when compared to the gold standard method. Examining statistics demonstrated that both techniques could be utilized to diagnose bacterial vaginosis ($p<0.05$) (Table 3).

Antenatal patients in the age range of 26–30 years were the most likely to have UTIs, followed by those in the 21-25y/o age range.

Table 3. Diagnosis of Bacterial Vaginosis (BV) through comparison of Nugent's scoring and Amsel's criteria.

Method of diagnosis		Diagnosis of BV by Nugent scoring		
		Score >7	Score 0-6	Total
Amsel's criteria	BV present	28	7	35
	BV absent	14	151	165

BV and UTI occurred in 40.4% of patients. The link between BV and UTI has been significant ($p<0.05$) (Table 4).

Discussion

In this report, nearly 77.5% of study participants had vaginal discharge as their main complaint and criterion. This was consistent with research by Agarwal *et al*. [2], who reported an 84% prevalence. We also found 23% fewer clue cells than a previous study (64%). A noteworthy association was observed between the incidence of symptoms such as burning micturition, lower abdomen pain, foul-smelling discharge, and bacterial vaginosis.

According to Amsel's criteria, the prevalence of BV was 17.5%, but Nugent's scoring criteria revealed a 21% prevalence in 200 samples. Similar results were found in studies conducted by Nawani *et al.* [20] in Kanpur and Rajeshwar Rao *et al*. [14] in Hyderabad. However, the current findings differ from those of several previous studies in that they show more instances of BV using Amsel's criteria than Nugent's scoring system [12,16]. The variation may be because BV is difficult to diagnose, and these tests are not available in most of the laboratory diagnostic tests menu and require some expertise.

The values of Amsel's criterion were as follows: 53.1% for sensitivity, 85.1% for specificity, 40.4% for PPV, and 90.5% for NPV. Statistical analysis results depicted that both approaches may be utilized to identify bacterial vaginosis. The results of a similar study by Modak *et al.* [15] and Taj *et al.* [22]. When compared to the others, Udayalaxmi *et al.* [12] and Hossien *et al.* [23] demonstrated- higher sensitivity using Amsel's criteria. These may be part of the reasons for the heterogeneity in clinicians' interpretation of BV results. As stated by Baverly *et al.* [6], Amsel's BV diagnosis criteria are less sensitive despite being simple. Gram staining is a repeatable and reliable BV diagnosis method, so Amsel's criteria must be confirmed, as suggested by Baverly *et al*.

UTI was found in 32 (16%) and BV in 42 (21%) patients. Out of the 42, about 17 (35.7%) had UTI. The link between BV and UTI was significant ($p<0.05$). Additionally, research by Hillerbrand *et al.* [10] has shown that pregnant patients with BV are substantially more likely to get UTI. Raised vaginal pH due to a decrease in vaginal lactobacilli is likely where the relationship between BV and urinary tract infection first appears. Lactobacilli produce numerous bacteriocins which have been effective against bacteria and fungi. Therefore, the patient is more vulnerable to urinary tract infection after BV disturbs the vaginal ecology and permits the colonization of possible uropathogens [13].

Sexual activity plays a significant role in BV and UTI. Bacterial vaginosis is facilitated by the imbalance in vaginal microbiota brought on by semen [24]. The urethral colonizers are moved into the bladder more easily by the urethral massage that occurs during sexual activity. Other factors that may contribute to the development of UTI associated with vaginitis across communities include personal hygiene, education, sociocultural practices, living standards, and individual awareness [3].

To summarize, BV stands as the most prevalent form of vaginitis in pregnant women, posing risks such as premature rupture of membranes, abortion, and preterm labor. Recent literature highlights the critical role of accurate diagnosis, with Nugent's scoring system exhibiting superior sensitivity for identifying BV. Conversely, Amsel's criteria offer valuable negative predictive value, effectively ruling out the condition. By integrating these two diagnostic methods, clinicians can enhance the precision of BV detection, leading to improved management strategies and outcomes for pregnant patients. This combined approach aligns with contemporary guidelines advocating for thorough screening practices in obstetric care.

Table 4. Association between Bacterial Vaginosis (BV) and Urinary Tract Infections (UTI).

Diagnosis	UTI present	UTI absent	Total
BV present	17	25	42
BV absent	15	143	158
Total	32	168	200

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