

Bacterial profile of high vaginal swabs in patients with preterm prelabor rupture of membranes at the Queen Elizabeth Hospital, Barbados and implications for antibiotic management

Keturah Murray, Na Tisha Robinson

ABSTRACT

Aims: The aim of this study was to identify the bacterial organisms found in patients with preterm prelabor rupture of membranes (PPROM) at Queen Elizabeth Hospital (QEH). Hypothesis: “*Escherichia coli* (*E. coli*) is the most commonly isolated bacterial organism from high vaginal swabs in patients with PPRM at the Queen Elizabeth Hospital.” Preterm prelabor rupture of membranes refers to membrane rupture before the onset of uterine contractions occurring before 37+0 weeks of gestation. Genital tract infection is an important risk factor of PPRM. Identification of organisms associated with PPRM allows for targeted antibiotic therapy.

Methods: A retrospective cohort analysis was done using data from January 2024–December 2024 (12 months), to characterize the microorganisms identified in the high vaginal swabs (HVS) done in women admitted to QEH with a diagnosis of PPRM. A total of 31 women were included in the study. Under aseptic conditions, sterile high vaginal swabs were taken from the posterior fornix of the vagina of each patient. Fisherbrand modified amies charcoal transport medium was used. Swabs were transported to the laboratory within 24

hours of collection and stored at incubation temperatures of 35–37 °C. The samples were cultured on blood agar, Sabouraud Dextrose Agar (SDA), MacConkey agar, and Thayer–Martin agar for microbial isolation. The presence of creamy to white colonies on SDA was used to identify yeast. Gray colonies on blood agar confirmed bacterial vaginosis associated *Gardnerella vaginalis*. Data were collected from the antenatal ward admissions books and results of HVS were obtained from Schuynet (a web-based laboratory information system used at QEH).

Results: Of the 31 women, the results of 29 samples were obtained. Culture growth was present in the high vaginal swabs of 13 women (44.82%; 95% CI: 28.4–62.5%). Three different types of pathogens were identified: yeast in 10 women 34.48% (95% CI: 19.9–52.7%), bacterial vaginosis in 3 women; 10.34% (95% CI: 3.58–26.4%) and Group B Streptococcus in 3 women; 10.34% (95% CI: 3.58–26.4%).

Conclusion: Identifying these bacterial patterns is essential for selecting effective antibiotics. These data lead to the question of whether PPRM patients are receiving correctly targeted antibiotic treatment.

Keywords: Culture, High vaginal swab, Preterm birth, PPRM

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INTRODUCTION

Preterm prelabor rupture of membranes (PPROM) complicates 2–4% of all singleton and 7–20% of twin pregnancies [1]. It accounts for 30–40% of preterm births, the causes are multifaceted; however, cervicovaginal infection is the most significant [2]. The main goals of treatment are to optimize maternal and neonatal outcomes, prolonging pregnancy where applicable, reducing risk of sequelae such as chorioamnionitis and managing risks of preterm birth.

Due to the lack of local data on bacterial profiles in patients with PPRM, our institution relies heavily on international guidelines, which may not fully reflect the unique bacterial prevalence and resistance patterns in our population. This gap can lead to suboptimal antibiotic choices, increasing the risk of treatment failure and adverse outcomes. Local data help clinicians identify which bacterial organisms are most prevalent in the community, allowing for more targeted antibiotic therapies.

The aim of this study was to identify the bacterial organisms most commonly found in patients with PPRM at QEH. The hypothesis was that *E. coli* would be the most commonly isolated bacterial organism. By identifying prevalent organisms and their resistance patterns, the study could help refine treatment protocols, reduce inappropriate antibiotic use, and ultimately improve maternal and neonatal outcomes in our population.

MATERIALS AND METHODS

This was a retrospective cohort analysis, done at a tertiary care center in the Department of Obstetrics and Gynecology, Queen Elizabeth Hospital, Barbados. This study examined patients who were admitted between January and December of 2024 with a diagnosis of PPRM. Only patients with singleton pregnancies were included. Each antenatal ward at QEH maintains an admission book that records the date and admitting diagnosis of all patients. Upon review, PPRM patients were identified and the results of their HVS were obtained via Schuynet (a web-based laboratory information system used at QEH). After the culture report was obtained, data were entered using Microsoft Excel for Microsoft 365 MSO (Version 2501). All patient data were anonymized. A total of 31 patients were included.

RESULTS

A total of 31 women with a diagnosis of PPRM were included in this study. Growth of organisms was identified in the high vaginal swabs of 13 women; 44.82% (95% CI: 28.4–62.5%), while no growth was reported in the remaining 16 women; 55.17% (95% CI 37.5–71.6%). Results were not available for two of the participants (6.45%) (Table 1).

The HVS cultures from the samples collected identified 3 different types of pathogens. The organisms detected were yeast in 10 women; 34.48% (95% CI: 19.9–52.7%), bacterial vaginosis in 3 women; 10.34% (95% CI: 3.58–26.4%) and Group B Streptococcus in 3 women; 10.34% (95% CI: 3.58–26.4%) (Table 2).

The participants in this study included women between 18 and 42 years of age with the mean age being 28.3 ± 6.2 years. The majority of persons were multigravida 58.06% (95% CI 40.8–73.6%), and most women 51.61% (95% CI: 34.8–68%) were admitted at late preterm gestation. Early preterm and very preterm admissions each accounted for 19.35% of women (95% CI; 9.19–36.3%) whilst 9.68% (95% CI: 3.35–24.9%) were extremely preterm admissions (Table 3).

The mean latency periods were 3.1 (SD 2.5), 3.3 (SD 1.0), 2.3 (SD 0.5), and 6.7 (SD 1.2) days for late preterm, early preterm, very preterm, and extremely preterm groups respectively (Figure 1). A Kruskal–Wallis test demonstrated a statistically significant difference in latency periods across the groups (p = 0.046). The 95% confidence intervals were calculated using the Wilson score method.

Table 1: Organism growth in high vaginal swabs

	n	%
Present	13	44.82
Absent	16	55.17
Not available	2	6.45
Total	31	100

Table 2: Organisms isolated on high vaginal swabs

Organism	n	%
Yeast	10	34.48
Bacterial vaginosis	3	10.34
Group B <i>Streptococcus</i>	3	10.34

Table 3: Demographic data of patients

		n	%
Maternal age (years)	<20	3	9.67
	21–29	14	45.16
	>30	14	45.16
Parity	Multigravida	18	58.06
	Primigravida	13	41.93
Gestational age (weeks)		n	%
	34+0–36+6 (late preterm)	16	51.61
	32+0–33+6 (early preterm)	6	19.35
	28+0–31+6 (very preterm)	6	19.35
	<28 (extremely preterm)	3	9.68

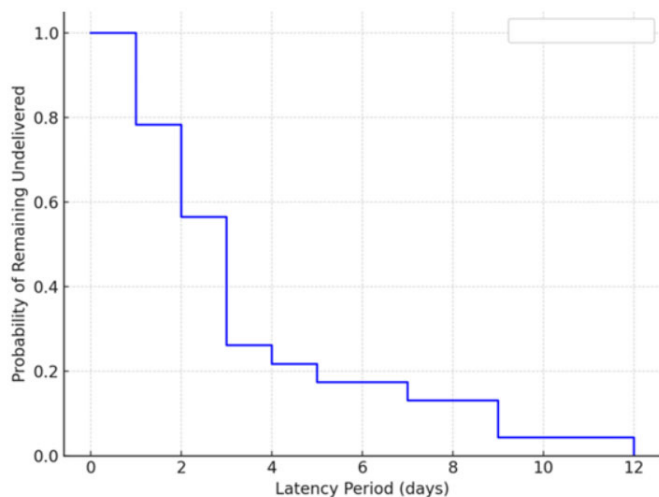


Figure 1: Kaplan–Meier-style latency curve.

DISCUSSION

In 2024, 1744 singleton births were registered at the QEH. Of these, 31 women were diagnosed with PPRM, representing 1.78% of pregnancies. This rate aligns with the established estimate that approximately 2–4% of pregnancies are complicated by PPRM.

Preterm prelabor rupture of membranes is a widely recognized condition that increases the risk of giving birth prematurely. The burden of PPRM ranges from maternal and neonatal mortality and morbidity to countrywide economic loss due to drug expense, hospitalization, absenteeism from the work, and expense to the health professionals [3]. It is responsible for around 30–40% of all cases of preterm deliveries. As PPRM is strongly associated with ascending vaginal infection, prophylactic antibiotics are widely used [4]. In this study, the vaginal bacteriological pattern of the women affected with PPRM was examined.

A total of 31 women were admitted to the obstetric wards with a diagnosis of PPRM. Most women 51.61% (95% CI: 34.8–68%) were admitted at late preterm gestation, 19.35% (95% CI: 9.19–36.3%) each were early preterm and very preterm, and 9.68% (95% CI: 3.35–24.9%) extremely preterm. This finding was similar to a cross-sectional study by Addisu et al., which looked at the prevalence of PPRM and its associated factors at a hospital in Ethiopia. In their study, 69.6% of women belonged to the gestational age of 34–36+6 weeks gestation [3]. Singh et al. also found the majority of their patients (47%) were admitted in this gestational category in their India based study [5].

In their analysis, 55% of the swabs were culture negative and 45% were culture positive. The positive culture rates in PPRM range from 21% and 45% [6]. The findings obtained in our study also fall in this range. Preetha found rates of 30% in their study [7] while Beevi et al. observed rates of 20% [8].

Among those cultures found positive, the organisms isolated were yeast (34.48%; 95% CI: 19.9–52.7%),

bacterial vaginosis (10.34%; 95% CI: 3.58–26.4%) and Group B Streptococcus (10.34%; 95% CI: 3.58–26.4%). While these data reflect the small population studied in this local cohort, other studies demonstrate the fact that types of organisms and their frequencies vary widely. Beevi et al. observed different organisms; *Escherichia coli* (8.6%), *Klebsiella* (4.8%), *Staphylococcus aureus* (3.8%), *Candida* (1.9%) and Methicillin-resistant *Staphylococcus aureus* (1%) [8]. Naseha et al. [7], Svavya et al. [6], and Abdel-Hakeem [9] all also identified *E. coli* as the most common organism. Bargaje et al. however found lower rates of *E. coli* (1.67%) and higher rates of other organisms; Coagulase-negative staphylococci (13.33%) followed by *Candida* species (8.33%) and *Klebsiella* species (5%) among total studied patients [10].

The mean latency periods amongst the groups were 3.1–6.7 days. In a study by Singh et al., most women in their study (74%) delivered within 24 hours of PPRM. Only 11% had a latent phase of more than three days, and 28.5% delivered within 25–72 hours. In a study by Sultana and Karmokar, the mean latency period was 27 hours [11].

Some studies have demonstrated an inverse relationship between gestational age and latency period [12]. Dale et al. found that pregnancies with gestational age less than 26 weeks had a three-fold longer duration of latency period than pregnancies with gestational age of 32–34 weeks [13]. Similarly, the patients of extreme preterm gestation had latency rates of two times longer than early preterm patients. Overall, however, the results of this study did not reflect a directly inverse relationship. The average latency periods were 3.1, 3.3, 2.3, and 6.7 days for late preterm, early preterm, very preterm, and extremely preterm respectively.

A significant limitation to this study is that antibiotic sensitivity testing is not performed at our laboratory, even when cultures yield positive results. This research has brought to the forefront a key area of improvement, establishing protocols for sensitivity testing for all positive cultures. The incorporation of both antibiograms and rapid molecular diagnostics would play a key role in enhancing the detection and characterization of vaginal pathogens. While traditional culture methods provide valuable information, they may miss fastidious organisms or take several days to yield results. By integrating antibiograms, we can assess the antimicrobial susceptibility patterns of isolates of the common organisms which were identified in this study. Additionally, the use of rapid molecular diagnostics, such as polymerase chain reaction (PCR) assays, would enable the direct detection of key bacterial species and resistance genes from high vaginal swabs. This approach offers faster turnaround times and higher sensitivity. Together, these strategies would provide a more comprehensive and timely understanding of the vaginal microbiota and its resistance patterns, ultimately improving patient management and antibiotic stewardship.

The relatively small sample size may not be sufficient to capture the full spectrum of bacterial patterns associated with PPROM. However, in resource-limited settings, large-scale prospective studies are not always feasible. The strength of this small retrospective cohort therefore is that it sheds light into the microbiological profile of high vaginal swabs in patients with PPROM.

Of note, the most common bacteria isolated was Group B *Streptococcus*. This study is the first of its kind in Barbados, as there is currently no local data available. While *E. coli* was initially anticipated to be the predominant organism based on findings from international literature, regional data suggest otherwise. A study conducted in Jamaica examining the microbiological profile of high vaginal swabs at a tertiary level hospital, found fungi to be the most commonly identified organism overall (headed by *Candida albicans*). A predominance of Group B *Streptococcus* (GBS) was found in the obstetric population. The findings of the present study are therefore consistent with regional patterns, reinforcing the importance of generating local data to guide clinical practice and antibiotic management [14].

Vulvovaginal yeast infections in pregnancy are common and can cause extensive inflammation. Pregnancy-associated changes such as increased estrogen levels, glycogen-rich vaginal secretions, and reduced vaginal pH contribute to this phenomenon [15]. The presence of yeast identified on a HVS can represent colonization, infection, or contamination. In asymptomatic patients, this is more likely to represent colonization. In the context of PPROM colonization can potentially carry greater clinical significance. Neither Gigi et al. nor Schuster et al., however, were able to identify evidence of strong statistical significance of adverse pregnancy outcomes associated with yeast infections [16, 17]. While contamination from the vulva or perineum during sample collection is possible, consistent and high rates of yeast isolation across samples would support colonization as a more likely explanation.

Vertical transmission of *Candida* can occur as a result of contamination of neonates when mothers with vaginal *Candida* colonization give birth [18]. Filippidi et al. found that although overall vertical transmission rates were low, the vast majority of colonized neonates were born to mothers vaginally colonized with a large quantity of *C. albicans* colonies (3+ or 4+), suggesting a correlation between candidal colony counts in the vagina of mother and *Candida* colonization in the neonate [19].

The optimal antibiotic regimen is unclear because multiple regimens have demonstrated benefit [20]. Our hospital has traditionally uses the Royal College of Obstetricians and Gynaecologists (RCOG) recommendation of erythromycin as first line treatment for patients with PPROM. The findings of this study underscore the need for antibiotic susceptibility testing to guide objective, evidence-based decisions about potential modifications to clinical protocols within our institution.

CONCLUSION

Maternal genital tract infection is one of the causes of preterm labor and PPROM. Most women in Barbados receive care at the QEH, rather than private facilities, therefore this research provides valuable insight into the local pathogenic profile of our population. The difference in findings between the local and international reports underscore the importance of research into local data.

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Author Contributions

Keturah Murray – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation

of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Na Tisha Robinson – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Guarantor of Submission

The corresponding author is the guarantor of submission.

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Written informed consent was obtained from the patient for publication of this article.

Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

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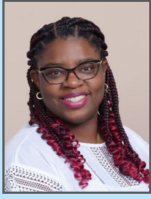
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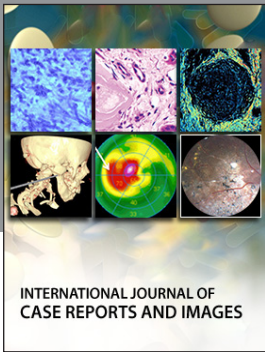
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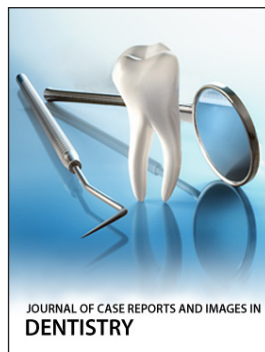
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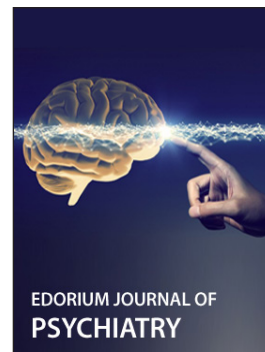
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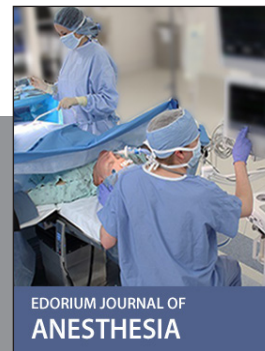
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