ORIGINAL ARTICLE

Vaginal Bacteriological Pattern in Women with and without Preterm Prelabor Rupture of Membranes: A Comparative Study

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Abstract

Aim: This study was carried out to determine the vaginal bacteriological pattern along with their antibiotic susceptibility pattern in pregnant women with preterm prelabor rupture of membranes (PPROM) and to compare them with those without PPROM. The association of PPROM with neonatal and maternal complications was also studied.

Materials and methods: This is an observational comparative study conducted in the year 2020 at a tertiary care teaching hospital located in Puducherry, India. The study included singleton pregnancies between 28 0/7 and 36 6/7 weeks of gestation with PPROM along with gestational age matched women without PPROM. A high vaginal swab was taken from all the candidates and sent for aerobic and anaerobic cultures. Organisms isolated along with their antibiotic susceptibility were noted and compared between the two groups. The software used was Statistical Package for the Social Sciences (SPSS) software, version 17.0 (IBM, Armonk, NY, USA).

Results: This study demonstrated an overall incidence of PPROM of 2.8%. A positive culture rate of 35.2 and 9.3% was found among pregnant women with and without PPROM, which was found to be statistically significant. The commonest organism isolated was *Escherichia coli* (52.6%) which was 100% sensitive to imipenem and meropenem and 90% to cefoperazone–sulbactam and was found to be resistant to ampicillin in 90% of cases. Neonatal complications such as respiratory distress and sepsis were found to be significantly higher in the PPROM group than in the comparison group.

Conclusion: There is no change in the vaginal microbiota in the last two decades, but the sensitivity pattern of antibiotics has changed considerably from the commonly used antibiotics to higher-generation antibiotics. This indicates indiscriminate use of antibiotics which has resulted in antibiotic resistance. This could be the probable reason for the increase in neonatal and maternal morbidity in PPROM.

Clinical significance: The vaginal microbiological flora and the antibiotic susceptibility pattern of the population in this area was studied and a significant change was noted over the past years which will help in formulating newer and better treatment protocols in the future which would help in reducing neonatal and maternal morbidities.

Keywords: Antibiotic sensitivity, Maternal morbidity, Neonatal morbidity, Preterm prelabor rupture of membranes, Treatment protocol, Vaginal microbiota.

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Introduction

The rupture of the amniotic sac prior to 37 weeks of gestation is known as PPROM. Globally, 2–3% of all pregnancies are complicated by PPROM.[1] Preterm labor, prematurity, chorioamnionitis, maternal, and neonatal infections, and negative maternal and newborn outcomes are all associated with PPROM. Infection is one of the most common causes of or outcome of PPROM, especially in India. According to reports, the rate of aberrant microbial colonization was higher in patients affected with PPROM than those without it. Various research projects conducted in India have reported the incidence of puerperal sepsis to be 17–20% and neonatal sepsis to be 20–22% in PPROM-complicating pregnancies.[2] Both gram-negative and positive bacteria are implicated in the causation of PPROM.

Over the period of time, the sensitivity pattern of micro-organisms has changed, but empirical treatment is a common practice.[3] Isolating the causative organism and administration of appropriate antibiotics in PPROM patients has been shown to significantly reduce clinical chorioamnionitis and in turn, reduce maternal and neonatal morbidity in several studies done globally.

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This study aimed at investigating the vaginal bacteriological pattern in women with and without PPROM and looked into their antibiotic sensitivity pattern. It also studied the association of PPROM with neonatal and maternal complications.

Materials and Methods

This comparative study was conducted in the Department of Obstetrics and Gynaecology, Mahatma Gandhi Medical College and Research Institute (MGMCRI), Sri Balaji Vidyapeeth, Puducherry, India between January 2020 and January 2021 after obtaining an institutional human ethics committee approval. Pregnant women having singleton, between 28 0/7 and 36 6/7 weeks with PPROM and without PPROM, were included in the study after obtaining informed consent. However, pregnant women with multifetal gestation, diabetes, immunosuppressed state, on steroids, and on prior antibiotics for PPROM were excluded.

A sterile speculum examination was performed for women complaining of discharge per vaginum for a demonstrable leak of amniotic fluid. Women with leaks were assigned to the PPROM group and high vaginal swabs were collected for aerobic and anaerobic culture. Blood agar, MacConkey agar, and chocolate agar were used for aerobic culture and anaerobic blood agar, egg yolk agar, Bacteroides bile esculin agar were used for anaerobic culture. These culture media were studied after 24 and 72 hours for aerobic and anaerobic growth.

A high vaginal swab was obtained from gestational age-matched women without PPROM. The vaginal bacteriological pattern between both groups was compared.

Pending the culture report, antibiotics, ampicillin, or erythromycin were started as per the department protocol for pregnant women with PPROM antibiotics and were changed, if necessary, after 72 hours based on antibiotic susceptibility. Women were followed up for the evidence of puerperal and babies were followed up for neonatal sepsis, by doing a sepsis screen as per the hospital protocol for 72 hours. Further management of both puerperal sepsis and neonatal sepsis was done as per the antibiotic susceptibility pattern

Statistical Analysis

The statistical analysis was done using statistical package for the social sciences (SPSS) software, version 17.0 (IBM, Armonk, NY, USA). All the categorical variables of the study, that is, age, socioeconomic status, parity, gestational age, growth of bacteria, mode of delivery, birth weight of the neonates, stay in NICU, neonatal complications, maternal complications in the two groups were summarized as percentages and were analyzed using Chi-squared test. A $p < 0.05$ was considered statistically significant.

Results

The total number of deliveries in the study period was found to be 2,460 of which 70 of them presented with PPROM accounting for an incidence of 2.8%.

The majority of patients with PPROM were found to be primiparous above 25 years of age and were belonging to a lower socioeconomic class. Late PPROM (between 32 0/7 and 36 6/7 weeks) was found to be more common than early. The hyperviscosity syndrome (HVS) positive culture rate among the cases with PPROM was found to be higher than those without PPROM. The difference in the positive culture rates was statistically significant (Table 1). The most common bacteria isolated in both groups was found to be *E. coli* (Table 2). Most of the organisms isolated were found to be resistant to the commonly used antibiotics and sensitive to higher antibiotics (Table 3). A greater proportion of PPROM-affected patients delivered low birth weight babies *via* cesarean section.

Table 1: Comparison of bacterial growth in the HVS

Growth of bacteria in HVS	*Women with PPROM*		*Women without PPROM*	
	n	*%*	*n*	*%*
Present	19	35.2	5	9.3
Absent	35	64.8	49	90.7
Total	54	100	54	100

Chi-squared $p = 0.001$; HVS, hyperviscosity syndrome

Table 2: Comparison of bacteria isolated from the HVS

Bacteria isolated	*Women with PPROM*		*Women without PPROM*	
	n	*%*	*n*	*%*
E. coli	10	52.6	4	80
Klebsiella	4	21.05	0	0
Enterococcus	4	21.05	0	0
Acinetobacter baumannii	1	5.3	0	0
Citrobacter diversus	0	0	1	20
Total	19	100	5	100

There was found to be a statistically significant difference in the neonatal complication rate among the two groups, the commonest one being respiratory distress (Table 4). There were no significant differences in the maternal complications in the two groups, the commonest one being urinary tract infection (Table 5).

Discussion

In this study, the vaginal bacteriological pattern of the women affected with PPROM was studied, and compared with gestational age-matched women without PPROM. The principle aim of the study was to identify the commonest organisms isolated and their antibiotic sensitivity pattern. The associated maternal and neonatal outcomes were studied as a secondary objective.

The incidence of PPROM reported by various authors varies from 2.4 to 3%.[4,5] In this study it was found to be 2.8%, which is similar to the available literature. It was also observed that the incidence of PPROM remained stable over the past two decades. This study has also reported the incidence to be more in low socioeconomic strata attributing to various factors like malnutrition, infection, and improper antenatal care.

The positive culture rates in PPROM range from 21% and 45% according to the studies conducted by Shivaraju et al.,[6] Adewumi et al.,[2] Shilpa et al.,[7] and Devi.[8] The findings obtained in this study also fall in this particular range. A significant difference in the positive culture rates was found in the two comparison groups, which suggests a strong correlation between the infection of the genital tract and the occurrence of PPROM. A similar association was found in the study done by Adewumi et al.[2]

This study has reported *E. coli* to be the commonest organism isolated in 52.6% of the PPROM cases. It was also found to be the commonest organism in the reported literature contributing to 30–53% in the studies done over the past few years.[2,5–8] According to the available data, it is quite evident that *E. coli* is consistently stable as the commonest organism isolated among the PPROM affected patients over time. Other common bacteria isolated were

Table 3: Antibiotic sensitivity pattern of bacterial isolates in PPROM

	E. coli (n = 10)		*Klebsiella (n = 4)*		*Enterococcus (n = 4)*		*Acinetobacter baumanii (n = 1)*	
Drugs	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Ceftriaxone	8	80	1	25	1	25	1	100
Gentamycin	7	70	4	100	1	25	0	0
Amikacin	7	70	3	75	1	25	0	0
Imipenam	10	100	3	75	3	75	1	100
Meropenam	10	100	3	75	3	75	1	100
Piperacillin–tazobactam	8	80	3	75	3	75	1	100
Cefoperazone–sulbactam	9	90	3	75	3	75	1	100
Ampicillin	1	10	0	0	2	50	0	0
Cotrimoxazole	3	30	2	50	2	50	0	0
Ciprofloxacin	4	40	3	75	1	25	1	100
Vancomycin	0	0	0	0	3	75	0	0
Linezolid	0	0	0	0	4	100	0	0
Teicoplanin	0	0	0	0	3	75	0	0
Erythromycin	0	0	0	0	0	0	0	0
Penicillin	0	0	0	0	3	75	0	0

Table 4: Comparison of neonatal complications

Neonatal complications	*Women with PPROM*		*Women without PPROM*	
	n	*%*	*n*	*%*
Respiratory distress	15	27.8	13	24.1
Sepsis	11	20.4	0	0
None	28	51.8	41	75.9
Total	54	100	54	100

Table 5: Comparison of maternal complications

Maternal complications	*Women with PPROM*		*Women without PPROM*	
	n	*%*	*n*	*%*
UTI	10	18.5	9	16.7
SSI	1	1.9	0	0
Chorioamnionitis	3	5.5	0	0
None	32	74.07	37	83.3
Total	54	100	54	100

Chi-squared $p = 0.08$

found to be Klebsiella and Enterococcus in this study as similarly seen in a few other studies.[2,7–10]

Antibiotic sensitivity analysis of the common organisms isolated in this study showed a higher percentage ofsensitivity to imipenem and meropenem followed by cefoperazone–sulbactam, piperacillin–tazobactam, ceftriaxone, amikacin, and gentamicin. All the above-mentioned drugs are relatively safe in pregnancy. Almost all of them showed either very low sensitivity or resistance to ampicillin and erythromycin both of which are commonly used antibiotics according to the standard protocols based on Guillain-Barré syndrome (GBS) prophylaxis which is being practiced in almost all parts of the world.[3]

This study reported the neonatal complications among the babies born to PPROM-affected mothers like respiratory distress, and sepsis accounting to 48.2% as was seen in a few other similar studies.[11,12] The organisms responsible for the genital tract infection were found to be the ones responsible for the causation of neonatal sepsis which was confirmed by neonatal blood cultures, hence showing a strong correlation between PPROM and neonatal sepsis.

This study revealed a maternal complication rate in the PPROM group to be 25.9%. Of all the complications that were encountered, febrile morbidity accounted to be the common finding due to complications like UTI, puerperal sepsis, wound infection, and chorioamnionitis. There was no significant difference in the maternal complication rate in women with and without PPROM due to which a positive correlation could not be obtained between them as obtained by few other similar studies.[10,13]

Although PPROM is one of the common complications of pregnancy, its consequences can very well be prevented by the use of appropriate antibiotics and thereby reducing maternal and neonatal morbidity significantly.

Limitations

This study had not elaborated on the risk factors in the occurrence of PPROM to remain focused on the objectives. Also, the latent period of the membrane rupture was not taken into account as it is a subjective finding and depends on the patient's memory which is usually unreliable. The susceptibility pattern for certain antibiotics could not be studied due to the non-availability of a particular disc occasionally.

Conclusion

The most common bacteria isolated in this study was *E. coli* in both women with and without PPROM. Although there is no change in the vaginal microbiota in the last few decades, the sensitivity pattern of antibiotics has changed considerably from the commonly used antibiotics to higher-generation antibiotics. This indicates

indiscriminate use of antibiotics which has resulted in antibiotic resistance.

Hence, appropriate institutional protocols, depending on the antibiotic sensitivity pattern, need to be developed for pregnancy with PPROM.

Clinical Significance

This study is one of the few studies conducted in recent times wherein the microbiological pattern was compared in women with and without PPROM. The vaginal microbiological flora and the antibiotic susceptibility pattern of the population in this area were studied and a significant change was noted over the past years which will help in formulating newer and better treatment protocols in the future.

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