A Study on Relationships between Cervicovaginal Bacteriology with Preterm Premature Rupture of Membrane in Pregnant Women

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Abstract

Background: Cervical bacterial infection is one of the main causes of Preterm Premature Rupture of Membranes (PPROM). The aim of this study was to identify the possible relationship with cervicovaginal bacterial infection in pregnant woman with preterm premature rupture of membrane.

Materials and methods: This cross sectional study was conducted in Department of Obstetrics and Gynaecology of Chittagong Medical College Hospital, Chattogram, Bangladesh from April 2021 to September 2021. A total of 50 pregnant women with preterm premature ruptures of the membrane (28-37 weeks) were included in this study.Using SPSS version 23, collected data were coded, modified, and classed before being input into the computer for statistical analysis.

Results: Culture of maternal high vaginal swab was positive in 39(78.0%) patients, among them 18(46.2%) patients were gram positive. Escherichia coli 11 (28.2%) was the most frequently isolated bacterium from high vaginal swab cultures. Age, antenatal check up, vulvo-vaginal itching, BMI and mode of delivery were significantly associated in patient with PPROM with high vaginal swab culture positive patients ($p<0.001$).

Conclusion: Culture of high vaginal swab in patients with PPROM was found positive in most of cases. Age, antenatal check up, vulvo-vaginal itching & BMI were significantly associated in patient with PPROM with high vaginal swab culture positive reports.

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Introduction

Rupture of Membrane (ROM) before 37 weeks of gestation and before the commencement of labor is known as Preterm Premature Rupture of Membrane (PPROM). Rupture of the membranes that occurs spontaneously before 37 weeks of pregnancy, either after or concurrently with the commencement of labor.[1] PPROM is the most common known cause of preterm delivery, accounting for 30–40% of preterm births. About 150,000 pregnancies in the US are complicated by Preterm Premature Rupture of Membranes (PPROM) which accounts for 3% of all pregnancies.[2] Following PROM, bacterial infection at the choriodecidual level with transient amnion involvement has been reported. Over the past few years, numerous studies have focused on the potential impact of cervicovaginal infections on the developing foetus.[3]

A shift in the typical vaginal flora can lead to the clinical illness known as Bacterial Vaginosis (BV). The typical vaginal flora dominated by lactobacilli is replaced by an overabundance of endogenous microbes.[4] The complex etiology of Bacterial Vaginosis (BV) is often linked to anaerobic Gram negative rods and positive cocci, as well as Gardnerellavaginalis, Mycoplasma hominis and Mobiluncus species.[5] A growing body of research from developed nations has demonstrated that BV is linked to pregnancy issues like postpartum endometritis, chorioamnionitis, Premature Rupture of Membranes (PROM) and Preterm Labor (PTL).[6] This study will focused on importance of identification of bacterial growth by high vaginal swab culture in patient with PPROM and also help to find out sensitive antibiotic in culture positive patient, ultimately help to reduce maternal and neonatal morbidity and mortality associated with PPROM related complications. The aim of this

study was to identify the possible relationship with cervicovaginal bacterial infection in pregnant woman with preterm premature ruptures of membrane.

Materials and methods

This cross sectional study was conducted in the Department of Obstetrics and Gynaecology of Chittagong Medical College Hospital, Chattogram, Bangladesh during the period of April 2021 to September 2021. A total of 50 pregnant women with preterm premature rupture of the membrane (28-37 weeks) were included in this study by purposive sampling. Patients PPROM with gestational age of 28-37 weeks and patients who gave informed written consent were enrolled in the study. Patient who did not gave consent and patients who was hemodynamically unstable were excluded from the study.Informed consent form was included in the study. A questionnaire was developed to collect date for further use of analysis. Total 50 samples were selected according to inclusion and exclusion criteria and fully informed about the purpose, methods, and guidelines of the research. She was urged to participate voluntarily and allowed freedom to withdraw from the study whenever she likes even after participation. After getting written informed consent thorough history and physical examination was done pre-formed data collection sheet was fill up before sample collection.Data was entered, cleaned and analyzed using Statistical Package for Social Sciences (SPSS -23) software. Proportions were compared using Chi-square test. Statistical significance was defined as $p \leq 0.05$.

Results

Out of 50 patients majority 17(34.0%) of patients belonged to age group 21-25 years with mean age 26.5±5.3 years. Most of the patients 31(62.0%) were between gestational age of 34-37 weeks and with mean gestational age was 31.7±2.1 weeks (Table-I). The culture of maternal high vaginal swab were positive in 39(78.0%) cases and were negative in 11(22.0%) cases (Figure-1). Out of 39 maternal high vaginal swab culture patients, 18(46.2%) microorganisms were gram positive. Most common isolated microorganism were Escherichia coli 11(28.2%) followed by Staphylococi epidermis 6(15.4%) (Figure-2). Spectrum of maternal age, antenatal check up, vulvo-vaginal itching, BMI and mode of delivery had significant association with high vaginal swab culture positive reports in patients with PPROM ($p<0.001$) (Table-II). Regarding antibiotic sensitivity 8(20.5%) micro organism were sensitive to Cefotaxime, 3(7.7%) were to Ciprofloxacin and 2(5.1%) were to Meropenum. Most common isolated micro organism in high vaginal swab culture was found Escherichia coli and most common sensitive antibiotic was found 3 (27.3%) Cefotaxime, 2(18.2%) Ciprofloxacin and 2(18.2%) Meropenum (Table-III).

Table I Demographic characteristics of the study patients (n=50)

Demographic characteristics	Frequency	Percentage (%)
Age group (years		
≤ 20	5	10.0
21-25	17	34.0
26-30	14	28.0
31-35	10	20.0
>35	4	8.0
Mean±SD	26.5±5.3	
Educational status		
Illiterate	5	10.0
Primary	9	18.0
SSC	19	38.0
HSC	11	22.0
Graduation	6	12.0
Occupational status		
Housewife	38	76.0
Service holder	7	14.0
Others	5	10.0
Antenatal check up		
Regular	15	30.0
Irregular	35	70.0
Maternal risk factors		
Vulvo-vaginal itching	31	62.0
Gestational DM	9	18.0
Pregnancy induced hypertension	7	14.0
Mode of delivery		
Vaginal delivery	46	92.0
Caesarean section	4	8.0

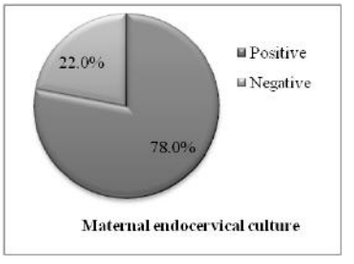

Figure 1 Distribution of maternal high vaginal culture in PPROM cases (n=50)

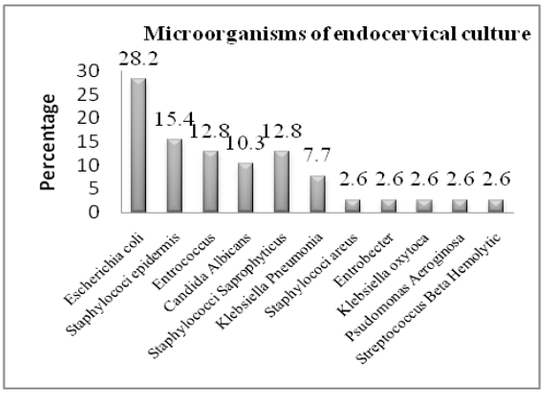

Figure 2 Distribution of microorganisms of high vaginal swab culture in PPROM cases (n=39)

Table II Risk factors of maternal high vaginal swab culture in PROM cases

Risk factors	Maternal high vaginal swab culture				p Value
	Positive (n=39)		Negative (n=11)		
	n	%	n	%	
Age group (Years)					
≤ 20	5	12.8	0	0.0	
21-25	15	38.5	2	18.2	
26-30	11	28.2	3	27.3	0.002^{s}
31-35	8	20.5	2	18.2	
>35	0	0.0	4	36.4	
Educational status					
Illiterate	4	10.3	1	9.1	
Primary	7	17.9	2	18.2	
SSC	15	38.5	4	36.4	0.989^{ns}
HSC	8	20.5	3	27.3	
Graduation	5	12.8	1	9.1	
Monthly income					
Lower	7	17.9	2	18.2	
Lower middle	22	56.4	5	45.5	0.762^{ns}
Upper middle	10	25.6	4	36.4	
Antenatal check up					
Regular	6	15.4	9	81.8	0.001^{s}
Irregular	33	84.6	2	18.2	
Menstrua lcycle					
Regular	23	59.0	6	54.5	0.792^{ns}
Irregular	16	41.0	5	45.5	
Vulvo-vaginal itching	27	69.2	4	36.4	0.047^{s}
Gestational DM	6	15.4	3	27.3	0.364^{ns}
Pregnancy induced hypertension	5	12.8	2	18.2	0.650^{ns}
BMI (kg/m^2)					
	<18.5	8	20.5	1	9.1
18.5-24.9	29	74.4	5	45.5	
25-29.9	2	5.1	3	27.3	0.004^{s}
≥ 30	0	0.0	2	18.2	
Mode of delivery					
Vaginal delivery	38	97.4	8	72.7	0.007^{s}
Caesarean section	1	2.6	3	27.3	

s=significant, ns=not significant
p value reached from Chi square test.

Table III Antibiotic sensitivity pattern for cultured microorganisms

Microorganisms of endocervical culture	Total	No sensitivity	Amikacin	Ampicillin	Vancomycin	Amoxicillin	Cephoprazone	Ofloxacin	Ciprofloxacin	Levofloxacin	Gentamycin	Doxycyclin	Erythmycin	Cefotaxime	Cephradin	Meropenum
Escherichia coli	11	2 (18.2)	-	1 (9.1)	-	-	-	-	2 (18.2)	-	1 (9.1)	-	-	3 (27.3)	-	2 (18.2)
Staphylococi epidermis	6	3 (50.0)	-	-	1 (16.7)	-	-	1 (16.7)	-	-	-	-	1 (16.7)	-	-	-
Entrococcus	5	1 (20.0)	-	-	-	1 (20.0)	-	-	2 (40.0)	-	-	-	-	1 (20.0)	-	-
Candida Albicans	4	4 (100)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Staphylococci Saprophyticus	5	2 (40.0)	1 (20.0)	-	-	-	-	-	-	-	-	-	-	1 (20.0)	1 (20.0)	-
Klebsiella Pneumonia	3	1 (33.3)	-	-	-	-	-	-	-	1 (33.3)	-	-	-	1 (33.3)	-	-
Staphylocociareus	1	1 (100)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entrobecter	1	1 (100)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Klebsiellaoxytoca	1	-	-	-	-	-	-	-	-	-	-	-	-	1 (100)	-	-
Psudomonas Aeroginosa	1	-	-	-	-	-	-	-	-	-	-	-	-	1 (100)	-	-
Streptococcus Beta Hemolytic	1	-	-	-	-	-	-	-	-	-	-	1 (100)	-	-	-	-
Total	39	15 (38.5)	1 (2.6)	1 (2.6)	1 (2.6)	1 (2.6)	1 (2.6)	1 (2.6)	3 (7.7)	1 (2.6)	1 (2.6)	1 (2.6)	1 (2.6)	8 (20.5)	1 (2.6)	2 (5.1)

Discussion

Cervical bacterial colonization is one of the most significant etiologies of Preterm Premature Rupture of Membranes (PPROM).[7]

In present study observed that majority 31(62.0%) of patients had vulvo-vaginal itching, 9(18.0%) had gestational diabetes mellitus and 7(14.0%) had pregnancy induced hypertension. Most of the patients 31(62.0%) had gestational age of 34-37 weeks and with mean gestational age was 31.7±2.1 weeks. According to a research by Saghafi et al. 43.3% of cases had a history of PROM during a prior pregnancy. Comorbidities were present in 21% of cases, with gestational and overt diabetes being the most common.[7] A gestational age of 31.5±2 weeks was the mean.PIH, DM and GDM incidence were reported by Yeasmin et al. to be 13.5%, 10.5%, and 10.5%, respectively.[8]

Regarding mode of delivery in this study observed that incidence of vaginal delivery was much more 46(92.0%) higher than caesarean section was 4(8.0%). Suleiman et al. described that over two-third (70.5%) patients had spontaneous vaginal delivery and 18(29.5%) had caesarean section.[9]

In this present study observed that culture of maternal high vaginal swab was found positive in 39(78.0%) cases and negative in 11(22.0%) cases. Out of 39 high vaginalculture positive cases, 18(46.2%) micro organism were gram positive, 18(43.6%) were gram negative and 4(10.3%) were fungal species. According to Saghafi et al. investigation of endocervical culture revealed that 136 cases (68%) were culture positive and 64 instances (32%) were culture negative, gram positive micro organisms were found in 58 cases (29%) and gram negative cases in 62 cases (31%) of the evaluation.[7] Musaba et al. noted that out of the 58 positive cultures, 67 isolates were found; of these, gram positive aerobic bacteria made up 63%, while anaerobes made up just 5 (7.5%).[10]

Regarding microorganisms of high vagina swab culture cases, most common isolated microorganism were Escherichia coli 11(28.2%) followed by Staphylococi epidermis 6(15.4%), Entrococcus 5(10.3%), Staphylococci Saprophyticus 5(10.0%) and Klebsiella Pneumonia 3(7.7%). According to Saghafi et al. 16 cases (8%) of fungus species were discovered. Escherichia coli (E. coli) was the most common pathogen in the endocervical cultures, appearing in 33 cases (24.2%). Next in order of frequency were Staphylococci epidermis (20 cases = 14.7%), Staphylococci saprophyticus (17 cases = 12.5%), Enterococcus saprophyticus, and Candida species (16 cases in each group = 11.7%).[7] Nguyen et al. reported that in PROM cases, Enterococcus spp was 4(11.8%), S. aureus 7(8.9%).[11]

Out of 39 high vaginal swab culture positive patients, antibiotic sensitivity was found in 24(61.5%) cases and resistance was 15(38.5%) cases. Among them 8(20.5%) micro organism was sensitive to antibiotic Cefotaxime, 3(7.7%) to Ciprofloxacin and 2(5.1%) to Meropenum. Most common isolated micro organism in high vaginal culture is Escherichia coli and most common sensitive antibiotic were found 3(27.3%) Cefotaxime, followed by 2(2(5.1%) Ciprofloxacin and 2(18.2%) Meropenum. 54.4% of the cultivated bacteria assessed by Saghafi et al.'s antibiogram showed at least one antibiotic group sensitivity. The majority of resistant bacteria (15.4%) was linked to both penicillin and macrolide. Approximately 50.8% of cultured microorganisms were resistant to at least one class of standard antibiotics that were treated in PPROM cases (Penicillin, cephalosporin, macrolide and cefotaxime).[7] According to Zeng et al. study, which conducted a systematic review in this area, the majority of staphylococcus species (Areus and epidermis) were resistant to penicillin (66–100%), with the exception of cloxacilin, when it came to the drug sensitivity of colonized bacteria.[12]

Limitations

The current study was conducted at a very short period of time. Small sample size was also a limitation of the study. Therefore, in future further study may be under taken with large sample size.

Conclusion

The study showed that culture of high vaginal swab for microorganism in patient with PPROM was found positive in most of the cases. Most common isolated microorganism of high vaginal swab culture was Escherichia coli. Spectrum of age, antenatal check up, vulvo-vaginal itching, BMI and mode of delivery had significant association with PPROM with high vaginal swab culture positive patient. Most common sensitive antibiotic wereCefotaxime, Ciprofloxacin and Meropenum.

Recommendations

To support the optimal preventive antibiotic selection in PPROM patients based on the most common bacterial colonization and neonatal blood culture, more research needs to be done.

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Contribution of authors

ANU-Conception, design, acquisition of data, data analysis, manuscript writing & final approval.

ZR-Data analysis, critical revision & final approval.

SS-Acquisition of data, drafting & final approval.

RA-Acquisition of data, drafting & final approval.

RB-Analysis, critical revision & final approval.

SAK-Interpretation of data, critical revision & final approval.

SB-Design, critical revision & final approval.

Disclosure

All the authors declare no competing interest.

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