

**Original Article****Antibiotic Sensitivity Pattern of Bacterial Growth in Vaginal Swab in Premature Rupture of Membrane: an Observational Study**M Rahman<sup>1</sup>, T Tayaba<sup>2</sup>, LR Biswas<sup>3</sup>, D Zeba<sup>4</sup>, Z begum<sup>5</sup>, S Alam<sup>6</sup>, S Parvin<sup>7</sup>**Abstract:**

Premature Rupture of Membranes is one of the important causes of preterm delivery and is associated with increased rates of neonatal and maternal morbidity and mortality. Maternal ascending infection is an important cause of Premature Rupture of membrane and may lead to life threatening sepsis in both mother and baby. This study was aimed to determine the antibiotic sensitivity pattern of microorganisms isolated from vagina of patient with premature rupture of membrane. It was a cross sectional study carried out in FMCH from August 2022 to January 2023 among pregnant women who met inclusion criteria. High vaginal swabs were collected by sterile speculum examination. Smears were sent to ICDDRDB for culture and investigation of sensitivity patterns. Of the high vaginal swabs collected 28% were sterile and 72% had positive culture. The most common organism isolated was *Staphylococcus aureus* (42%) and second most common *E.coli* (14%) other microbes isolated were *Enterococcus* (8%), *Group B streptococcus* (2%) and *Bacteroides* was (2%). Amoxiclav, Clindamycin, Gentamycin, Linezolid, Teicoplanin, Tigecycline, Vancomycin, Imipenem were found to have appropriate pattern. Common isolates were found to be resistant to Ampicillin, Erythromycin, Ceftriaxone. Use of appropriate antibiotic in Premature Rupture of Membrane can improve maternal and fetal outcome.

**Key words:** PROM, Vaginal swab, Bacterial growth.**Introduction:**

Premature rupture of membrane (PROM) is defined as rupture of the fetal membrane prior to the onset of labor<sup>1,2</sup>. Approximately 10% of all pregnancies are complicated by

PROM. It is responsible for 30% to 40% of all preterm deliveries and is one of the most common underlying causes of low birth weight and perinatal death<sup>1,3</sup>.

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PROM is the single most common cause associated with preterm delivery. It is prolonged when it occurs more than 18 hours before labor. PROM is preterm when it occurs before 37 weeks of gestation<sup>1,3</sup>.

Most common complications of PROM are preterm labour, maternal infection (chorioamnionitis, endometritis, sepsis), early neonatal sepsis, intraventricular hemorrhage, necrotizing enterocolitis and meningitis<sup>4</sup>. Many studies have determined that besides prematurity, infection was the most serious event and potential complication following PROM. Organisms resistant to empirical antibiotics used in PROM intensify the pregnancy complications several times, thereby leading many more deaths of fetus and newborn and increases maternal morbidity<sup>5</sup>. The etiology of PROM is largely unknown. The possible causes are either reduction of membrane strength, an increase in intrauterine pressure or both<sup>6</sup>. It may be associated with an incompetent cervix, unstable lie, polyhydramnios, multiple gestation or possibly bacteriuria, specially beta-streptococci infection<sup>7</sup>. Infection in the female reproductive tract with *E. coli*, *Staphylococcus*, *Streptococcus*, *Enterococcus*, yeast, *Ureaplasma urealyticum*, *Mycoplasma* is associated with PROM and preterm labor<sup>8-11</sup>. This process is in turn, responsible for many preventable infant deaths. Anti-bacterial therapy when used in the expectant management of preterm PROM is associated with prolongation of pregnancy and a reduction in the maternal and fetal morbidity<sup>12-13</sup>. PROM is very often seen in a busy obstetric ward in our country. Proper diagnostic facilities, proper monitoring facilities and a standard protocol in the management can improve the maternal and fetal outcome.

PROM has a wide spectrum of research material, new lights are focused on the subject mostly in the developed countries, but very few such studies have been carried out in our country. In recent years the prevalence of antibiotic resistance is high in our country. Therefore, we felt the need of a study to determine the antibiotic sensitivity pattern of microorganisms isolated from vagina of patient with PROM.

### Materials and Methods:

This cross sectional observational study was conducted in the department of obstetrics and gynaecology FMCH, Faridpur over a period of 6 months from August 2022 to January 2023. During this period 50 cases of PROM admitted in department of obstetrics and gynaecology were included in the study by simple random sampling. Women both primi and multi gravida more than 24 weeks of gestation with single cephalic fetus having spontaneous rupture of membrane before initiation of labor were enrolled in this study. Women with polyhydramnios, H/O PROM in previous pregnancy, H/O cervical incompetence, IUD, APH were excluded

from study. The study's aims and objectives were explained to all participants and their written informed consent was obtained. Confidentiality was strictly maintained as per medical ethics. The diagnosis of spontaneous rupture of the membrane was confirmed by inspecting the cervix, with sterile Cusco's speculum for flow of amniotic fluid from the cervical os and a high vaginal swab was taken from posterior fornix of the vagina maintaining sterility at that time. It was stored in refrigerator and carried by cooling box at 2-8°C temp. Vaginal swabs were sent to ICDDR, B maintaining cold chain. Culture was done in aerobic and microaerophilic condition at 35 degree centigrade. Culture and sensitivity were done per standard protocols. Identification of pathogens was done and significant pathogens were then evaluated for antimicrobial susceptibility using commonly used antibiotics. Other data were collected by interview, brief history, physical examination using a preformed semi structured questionnaire containing all the variables of interest. After collection, data were checked and analyses were done by Statistical Package for Social Science (SPSS) for windows version -23.

### Results:

Among 50 cases majority of the study subjects were 21-25 years of age (Table I).

**Table I:** Distribution of patient according to age (n = 50)

Age in years	No. of patients (%)
≤20	15 (30%)
21-25	21 (42%)
26-30	9 (18%)
31-35	5 (10%)
36-40	0
<b>Total</b>	<b>50 (100%)</b>

According to comparison of patients by gestation age of occurrence of PROM, most were preterm PROM (92%) (Table II).

**Table II:** Distribution of patients according to term and preterm PROM (n=50)

Types of PROM	No of patients (%)
Term PROM	4 (8%)
Preterm PROM	46 (92%)

According to culture, 28% specimens were sterile and growth found in 72% specimen (Table III).

**Table III:** Distribution of patients according to bacteriological presentation in high vaginal swab culture (n=50).

High vaginal swab culture	Number of Growth (%)
No growth	14 (28%)
Single growth	30 (60%)
Multiple growth	6 (12%)

Table IV shows isolated microorganism by culture. Among them *Staphylococcus aureus* = 21 (42%), *E. coli* = 7 (14%) and *Enterococcus* = 4 (8%). *Candida* was found in 7 women among them 6 were isolated and 1 with other bacteria (Table IV).

**Table IV:** Distribution of patients according to types of growth in high vaginal swab culture (n=50).

Name of organism	Number of Growth
<b>Gram positive</b>	<b>26 (52%)</b>
<i>Staphylococcus aureus</i>	21 (42%)
<i>GBS</i>	1 (2%)
<i>Enterococcus sp</i>	4 (8%)
<b>Gram negative</b>	<b>9 (18%)</b>
<i>E. coli</i>	7 (14%)
<i>Bacteroides</i>	1 (2%)
<i>Klebsiella</i>	1 (2%)
<i>Candida albicans</i>	<b>7 (14%)</b>

Analysis of antibacterial sensitivity pattern of commonly found organisms showed that Amoxiclav, Gentamycin and Tigecycline are sensitive antibiotics for both Gram positive and Gram negative bacteria in majority of cases. Clindamycin, Teicoplanin, Doxycycline, Linezolid, Vancomycin are very sensitive in majority of cases of *Staphylococcus* and other Gram positive bacteria. Amikacin, Colistin & Imipenem are sensitive to *E. coli*. However, resistance to Ampicillin, Ceftriaxone, Cefixime, Erythromycin, Ciprofloxacin, and Penicillin were notably high (Table V).

**Table V:** Distribution of patients according to antibiotic sensitivity to organism (Sensitive=S, Intermediate=I, Resistant=R)

Antibiotic	Staphylococcus Aureus (21)	E. coli & other Gram (-) ve (9)	Enterococcus (4)	GBS (1)	Total sensitivity (%)
Amikacin	-	S-7 (78%) R-2 (22%)	-	-	S-7 (78%) R-2 (22%)
Amoxiclav	S-17 (81%) R-4 (19%)	S-6 (67%) R-3 (33%)	S-4 (100%)	S-1 (100%)	S-28 (80%) R-7 (20%)
Ampicillin	-	S-1 (14%) R-6 (85%)	-	-	S-1 (25%) R-6 (75%)
Cefixime	-	R-7 (100%)	-	-	R-7 (100%)
Ceftazidime	-	S-4 (44%) R-5 (56%)	-	-	S-4 (44%) R-5 (56%)
Ceftriaxone	S-9 (42.5%) R-12 (57.5%)	S-1 (12.5%) R-7 (87.5%)	- -	S-1 (100%)	S-11 (37%) R-19 (63%)
Cefuroxime	-	R-7 (100%)	-	-	R-7 (100%)
Ciprofloxacin	S-8 (38%) I-2 (9%) R-11 (53%)	S-2 (22%) I-1 (11%) R-6 (67%)	I-1 (25%) R-3 (75%) -	- - -	S-10 (29%) I-4 (12%) R-20 (59%)
Clindamycin	S-18 (90%) R-2 (10%)	- -	- -	R-1 (100%)	S-18 (86%) R-3 (14%)
Colistin	- -	S-8 (89%) R-1 (11%)	- -	- -	S-8 (89%) R-1 (11%)
Doxycycline	S-19 (90%) R-2 (10%)	- -	I-1 (25%) R-3 (75%)	S-1 (100%)	S-20 (77%) I-1 (4%) R-5 (19%)
Erythromycin	S-3 (15%) R-17 (85%)	- -	R-3 (100%) -	R-1 (100%)	S-3 (12.5%) R-21 (87.5%)
Gentamycin	S-19 (90%) R-2 (10%)	S-6 (67%) R-3 (33%)	S-2 (50%) R-2 (50%)	- -	S-27 (79%) R-7 (21%)
Imipenem	-	S-8 (89%) I-1 (11%)	- -	- -	S-8 (89%) I-1 (11%)
Linezolid	S-20 (100%)	-	S-3 (75%) R-1 (25%)	S-1 (100%)	S-24 (96%) R-1 (4%)
Penicillin	S-2 (10%) R-18 (90%)	- -	S-3 (75%) R-1 (25%)	S-1 (100%)	S-6 (23%) R-20 (77%)
Piperacillin	-	S-4 (44%) R-5 (56%)	- -	- -	S-4 (44%) R-5 (56%)
Tigecycline	S-21 (100%)	S-8 (89%) R-1 (11%)	S-4 (100%)	S-1 (100%)	S-34 (97%) R-1 (3%)
Teicoplanin	S-21 (100%)	-	S-4 (100%)	-	S-25 (100%)
Vancomycin	S-21 (100%)	-	S-4 (100%)	S-1 (100%)	S-26 (100%)

### Discussion:

In the present study we found that 30% of study population were age group of  $\leq 20$  years, 42% were age group of 21-25 years because most of our obstetric population is in this age group. This study showed that majority (92%) were preterm PROM and (8%) were term PROM.

In our study the commonest bacteria isolated was *Staphylococcus* 42% and second one is *E. coli* 18%. Total 28% cases were found sterile compared to 58.47% cases were sterile in study by Seshasai et al<sup>14</sup>. In study of MW Musaba<sup>15</sup> *Staphylococcus* was found in 20% cases and *E. coli* in 18% cases which were most common pathogens. A study in China at 2014 by Zeng Li-nan<sup>16</sup> et al showed two most common pathogens in PROM were *Staphylococcus* and *E. coli* which is similar to our study. In our study only 2% of the Group B-*Streptococcus* was isolated. This is different from other studies where by the colonization of Group B-*streptococcus* was found to be 5- 30%. If rectal swab could be taken the detection rate might increase<sup>17</sup>. Other organisms could not be isolated due to the non availability of medium for their isolation. Similar reasons can be added for the non isolation of *Chlamydia* organisms. *Bacteroides fragilis* was 2% in this study. *Candida albicans* was found in 14% cases.

Antibacterial therapy has been used as prophylaxis for prevention of infection following premature rupture of membrane. NICE<sup>18</sup> recommends oral Erythromycin as drug of choice. In this study Erythromycin is resistant in almost all cases of staphylococcus. In our set up we use Ceftriaxone or cefuroxime during treatment of PROM. ACOG<sup>19</sup> recommends a seven day course of oral or parenteral Azithromycin, Ampicillin and Amoxycillin in pregnant women with PROM. This approach although simplistic can lead to inadequate treatment if causative organisms are resistant to these antibiotics. Also wide spectrum resistance to penicillin group of antibiotics has been reported previously from India and other developing countries<sup>20</sup>.

In this study antibiotics such as Amoxiclav, Gentamycin and Tigecycline were shown to be very effective against most of the organisms both gram positive and gram negative. *Staphylococcus aureas*, *Enterococcus* and *GBS* were sensitive to Clindamycin, Teicoplanin, Linezolid and Vancomycin. *E. Coli* was sensitive to Amikacin, Colistin and Imipenem. Almost all bacteria showed marked resistance to Ampicillin, Cefixime, Ceftriaxone, Cefuroxime, Erythromycin and Penicillin. This was also seen in M W. Musaba<sup>15</sup>, Zeng Li-nan<sup>16</sup>,

R Malla<sup>8</sup> and Mc Gregor<sup>21</sup> study. As we can see Amoxiclav is sensitive to most of the organisms, it can be used antenatally without any adverse fetal outcome<sup>22,23</sup>. This study provides important data about microbiological correlate of PROM in our pregnant women.

### Conclusion:

This study has shown that bacterial pathogens were associated with preterm PROM and PROM. In our set up *Staphylococcus aureus*, *E.coli*, *Enterococcus*, *Candida albicans* were frequently isolated. In terms of microbial sensitivity majority of organisms both Gram positive & Gram negative were sensitive to Amoxiclav, Gentamycin, Tigecycline. Gram positive organisms were very much sensitive to Clindamycin, Doxycycline, Teicoplanin, Linezolid and Vancomycin. Where, Gram negatives were sensitive to Amikacin, Colistin, Imipenem. All types of bacteria showed marked resistance to Ampicillin, Cephalosporin, Erythromycin, Penicillin, Ciprofloxacin. In the present study sample size is 50 and period of study is 6 months. It is a smaller study, so other organism responsible for PROM could not be detected due to shortage of time and smaller sample size. Also organisms may vary from area to area as well as sensitivity patterns. So, larger study may help to know the actual picture.

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