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Research Article

MICROBIAL PROFILE AND ANTIBIOTIC SENSITIVITY IN PRETERM PREMATURE RUPTURE OF MEMBRANES (PPROM) AMONG PREGNANT WOMEN: IMPLICATIONS FOR TREATMENT IN RESOURCE-LIMITED SETTINGS

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ABSTRACT

This study aimed to identify prevalent microbes in pregnant women with preterm premature rupture of membranes (PPROM) and assess their susceptibility to various antibiotics, with the goal of determining appropriate antibiotic treatment strategies in resource-limited settings. Endocervical swabs were collected from all participants, and microbiological examination was conducted to identify the prevalent microbes. Antibiotic susceptibility testing was performed using the Kirby-Bauer disk diffusion method. The results revealed that Streptococcus spp., Staphylococcus aureus, and Escherichia coli were significantly more prevalent in women with PPROM ($P < 0.01$). Among the tested antibiotics, cefixime, cefuroxime, and erythromycin demonstrated the highest sensitivity during pregnancy. Based on these findings, it is recommended that in the first 48 hours after the onset of PPROM in women, intravenous administration of antibiotics such as ampicillin-sulbactam, cefixime, cefuroxime, or erythromycin should be initiated, followed by oral administration. These antibiotics were found to be effective against the prevalent microbes associated with PPROM, suggesting their potential utility in managing this condition in resource-limited settings. This study provides valuable insights into the microbial profile and antibiotic susceptibility patterns in pregnant women with PPROM, offering guidance for clinicians in selecting appropriate antibiotic therapies tailored to the microbial profile observed in this population. Further research is warranted to validate these findings and optimize antibiotic treatment strategies for PPROM in diverse clinical settings.

Key words:-. Preterm premature Membrane Rupture, Antibiotic Sensitivity Testing, Female genital tract, Microbiology, Preterm infants.

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INTRODUCTION

Early premature rupture of membranes (PPROM) occurs before the 37 week mark of a pregnancy when the fetal membranes rupture before labor begins [1, 2]. In approximately one third of all preterm births, it occurs in 3% of pregnancies [3].

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The risk of PPROM to mother and fetus remains high despite advances in perinatal care [3–6]; there is an apparent link between PPROM and infections in the womb [7]. The use of antibiotics in PPROM is common, as antibiotics have been shown to prolong pregnancy and decrease neonatal morbidity. Ascending microbial agents are prevented from invading the uterus through the

administration of antibiotics. In order to determine the antimicrobial susceptibility pattern of the isolates, cultures of amniotic fluid a high vaginal swab as well as a low vaginal swab should be obtained. Interestingly, it is common for antibiotics to be prescribed without microbiological testing in resource-poor settings [11,12]. Consequently, antibiotic abuse is very likely, leading to serious health issues. The efficacy of broad-spectrum antibiotics examined none has been recommended. There is a common regimen for PPROM in the NICH trial. That regimen recommended intravenous ampicillin and erythromycin for 48 hours, followed by oral amoxicillin and enteric-coated erythromycin for 5 days [10, 13, 14]. In low-income countries, there has been no definitive recommendation concerning antibiotic treatment after PPROM. In resource-poor settings, PPROM poses a challenge in assessing antibiotic susceptibility. NICH does not recommend parenteral erythromycin for Nigerians. PPROM patients should not be treated with ampicillin due to prevailing antibiotic resistance. Pregnant women with and without PPROM were evaluated for their genital tract microbes, and their antibiotic susceptibility patterns were assessed. Healthcare institutions without laboratory facilities may recommend antibiotic treatment protocols based on the PPROM study conducted by the NICH.

METHODOLOGY

PPROM cases are often referred to the tertiary hospital. Women with PPROM who presented at Hospital's Labor and Delivery Unit were located on the second floor of the hospital between 28 and 37 weeks of pregnancy were classified as members of the PPROM group. Pregnant women in the non-PPROM comparison group were attending prenatal clinics without ruptured membranes. We matched a group of women with PPROM to a group of women without PPROM based on age, parity, and gestational age. In the PPROM group, women were excluded if they had PPROM before they presented, had previous digital examinations before they presented, received antibiotics within 7 days of presentation, or had active bleeding. A written informed consent was obtained from all participants and ethical approval was obtained from the Institutional Review Board. Samples were coded and numbered consecutively so that the microbiologist analyzing specimens had no idea which group they belonged to. Evaluation of rupture of membranes included a physical examination, history, and sterile speculum examination. Two of the following three clinical signs were present at the initial examination for membrane rupture: pooling of fluid, nitrazine positive test, or microscopic evidence of ferning. Results were measured by detecting microorganisms and measuring antibiotic susceptibility.

The senior scientist of a medical laboratory will perform the analysis. Dry chocolate agar, blood agar, MacConkey agar, and Sabouraud dextrose agar were used. Incubation was done for 24–48 hours at 37 °C. After inoculation, each swab was placed onto a microscope slide, which was then examined under a microscope under the light of a microscope with saline added. Using Oxoid multi discs containing standard antibiotic concentrations, Kirby-Bauer disk diffusion was modified to test samples that developed cultures of microorganisms. As per the Clinical Laboratory Standards Institute [16], measured zone sizes and an interpretation were made based on the results. As part of a recent study, pregnant women in hospitals, *Gardnerella vaginalis* was reported to be 17% prevalent. To achieve 85% power to detect a difference between 3.5% and 17.0%, 91 participants per group were required. Epi Info and PASS version 12 were used for power analysis and sample size calculations. 105 women were enrolled in each group to account for loss to follow-up. For determining whether PPROM and non-PPROM bacterial species had any significant differences in prevalence, Epi Info version 3.5.1 and Stata version 10 were used [15].

RESULTS

There were 210 women in the study table 1 shows the demographic characteristics of the participants. Both groups appeared homogeneous ($P<0.05$). It was found that the non-PPROM group had a mean age of 30.4 years, compared to 30.7 years for the PPROM group. Most women in the study had 0–2 children. Fertilization rate and gestational age were similar among PPROM and non-PPROM groups 31.4% x 1.8 weeks. A total of 166 (79.0%) of the samples collected from women with PPROM were bacterially contaminated (Table 2). *Staph.* PPROM participants were significantly more likely to identify these bacteria than non-PPROM participants (Table 2). The most effective antibiotic in the PPROM group was ampicillin-sulbactam: 162 (97.6%) of the166 bacterial isolates were susceptible (Table 3). This group showed low levels of effectiveness for ampicillin, ampicillin-cloxacillin, and co-trimoxazole: only 42 isolates (25.3%), 50 (30.1%), and 50 (30.1%) were sensitive. Neither gentamicin nor ceftriaxone were effective against Proteus mirabilis. Non-PPROM isolates are shown in Table 4.

Table 1: The study population was characterized by the following socio demographic characteristics

Characteristics	PPROM (n = 210)	Non-PPROM (n = 210)	χ^2	*P* value
Age, (yrs)			0.00	1.000
16–20	10	12		
21–25	22	22		
26–30	62	64		

31–35	84	82		
36–40	26	26		
41–45	6	4		
Parity			0.03	0.863
0	44	42		
1	58	60		
2	56	54		
3	12	6		
4	28	30		
≥5	12	18		
Gestational age, wk			0.00	1.000
28-30	72	70		
31–33	36	46		
34–36	102	94		
Level of education			0.50	0.478
No formal education	4	0		
Primary education	6	2		
Secondary education	136	122		
Tertiary education	64	86		
Marital status			0.50	0. 478
Single	4	0		
Married	206	210		

Table 2: Genital tract flora isolated from participating women.

Organisms	PPROM (n = 210)	Non-PPROM (n = 210)	*P* value
Streptococcus spp.	66	6	b0.001
Staphylococcus aureus	58	6	b0.001
Escherichia coli	20	2	0.005
Proteus mirabilis	10	0	0.070
Bacteroides spp.	8	0	0.130
Klebsiella pneumoniae	4	0	0.713
Negative specimens	44	196	b0.001
Total number of positive isolates	166	14	b0.001

Table 3: Isolated bacteria from the PPROM group are sensitive to antibiotics

Antibiotic	Streptococcus spp.	Staphylococcus aureus	Escherichia coli	Proteus mirabilis	Bacteroides spp.	Klebsiella pneumoniae
	(n = 66)	(n = 58)	(n = 20)	(n = 10)	(n = 8)	(n = 4)
UNAS	66	58	18	10	6	4
STRP	64	56	16	8	6	2
GENT	62	54	14	2	8	4
CEFI	60	52	14	6	2	2
CEFU	60	50	16	8	4	0
CIPR	58	54	16	10	4	4
CEFT	56	52	10	2	2	2
ERYTH	54	50	8	6	2	2
CO-AM	44	28	4	4	2	2
LEVO	40	34	2	2	2	2
COTR	22	20	6	2	0	0
AMOX	22	10	6	2	2	0
AMPI	20	20	6	2	2	0

Table 4: Isolated bacteria in the non-PPROM group are more susceptible to antibiotics.

Antibiotic	Streptococcus spp.	Staphylococcus aureus	Escherichia coli
	(n = 6)	(n = 6)	(n = 4)

UNAS	6	6	2
STRP	6	6	0
CEFI	6	6	2
GENT	6	4	2
CEFU	6	4	0
CIPR	4	4	0
CEFT	4	4	0
ERYTH	4	2	0
CO-AM	2	2	0
LEVO	0	2	0
COTR	0	0	0
AMOX	0	0	0
AMPI	2	0	0

DISCUSSION

Insignificantly Escherichia coli, Streptococcus species, and Staphylococcus aureus were associated. As a result, this group of bacteria may cause PPROM directly or may serve as markers for another pathogen. A strong body of evidence suggests that antibiotics are useful in the treatment of PPROM in contrast to preterm labor. Prophylactic antibiotic treatment is rational since infections may cause as well as result from PPROM [16-18]. Preventing infections in mothers and fetuses and extending their latency periods are the goals of antibiotic therapy. The most useful antibacterial drugs used were ciprofloxacin, ceftriaxone, erythromycin, streptomycin, ampicillin- sulbactam, ciprofloxacin, gentamicin, cefixime, cefuroxime, and ciprofloxacin followed by cefixime, cefuroxime, and coamoxiclav and these agents were able to kill the bacteria. Comomoxiclav, on the other hand, can cause neonatal necrotizing enterocolitis. In addition, parenteral erythromycin is not available in Nigeria, nor does it treat anaerobes, Group B streptococcus, or bacterial vaginosis.

72 (86.7%) of the bacteria were successfully treated with gentamicin, supporting conclusions [19]. Gentamicin cannot be taken orally, and it potentiates ototoxicity and nephropathy. Hence, Gentamicin should only be used when alternatives are unavailable or streptomycin is contraindicated for congenital anomalies. Ciprofloxacin in pregnancy has not been tested for safety. It appears that therapeutic doses of medications during pregnancy pose little teratogenic risks when taken during pregnancy.

The least effective antibiotics were a combination of amoxicillin, ampicillin and cloxacillin, as well as co-trimoxazole: only 21–25 (25.3%–30.1%) of the isolates were sensitive. In PPROM, antibiotic regimens have been found to be useful [20,21], which is a concerning finding. The study area uses them frequently. The use of ampicillin-cloxacillin is often regarded as a drug that is habitually used for self-medication, which could explain why only 25 isolates (31.3%) tested positive for ampicillin-cloxacillin.

We were unable to test the sensitivity to metronidazole due to the antibiotic disc being unavailable. PPROM is prevented in women with bacterial vaginosis by metronidazole, reports a study in the USA. Metronidazole is an antibiotic that is effective against a wide range of infections *G. vaginosis* and related bacteria.

There have been two large studies looking at the effectiveness of antibiotics for PPROM. In one of the groups enrolled as part of the study, intravenous antibiotics were given every 6 hours for 48 hours. An oral amoxicillin and erythromycin base combination was administered every 8 hours for a 7-day treatment. This study participants receiving antibiotic treatment had a shorter latency period. Antibiotic-treated women were twice as likely to remain undelivered. A prolonged latency lasted up to 3 weeks. Neonatally, antibiotic recipients had lower morbidity rates. Chorioamnionitis, necrotizing enterocolitis, and neonatal sepsis decreased. Co-amoxiclav alone or combined with erythromycin was used in the ORACLE trial [9]. Latency to delivery and neonatal morbidity did not differ significantly. In the USA, the antibiotic regimen is more commonly used for PPROM [13, 14]. In the case of patients with PPROM who are managed expectantly recommends 7 days of antibiotics.

There was sensitivity to ampicillin-sulbactam, cefixime, and cefuroxime in 81 and 69 cases, respectively. For the treatment of PPROM, it is recommended to use the following antibiotics in place of ampicillin, amoxicillin, and ampicillin-cloxacillin. Aside from this, there are many readily available antibiotics available, including ampicillin-sulbactam, cefixime, and cefuroxime. It has been recommended that 1.5g of ampicillin-sulfactam be administered intravenously every 12 hours in the present study, followed by 400mg cefixime, 250mg cefuroxime, 500mg erythromycin, or 375mg oral ampicillin-sulbactam is suggested, followed by 400mg cefixime, 250mg cefuroxime or 500mg erythromycin every 12 hours, followed by 500mg for a 7-day course of erythromycin, it is recommended that you take it every 8 hours. Penicillin allergies should be treated with cefixime or cefuroxime. In addition, the dosage of metronidazole is 500 mg every 8 hours for 48 hours, followed by 400 mg every 8 hours for 5 days

particularly in cases where anaerobe culture is difficult or G is detected by microscopy. The organisms are Gram-negative and anaerobic. Logistic difficulties prevented the isolation of bacteria from the genital tract, and metronidazole susceptibility testing was not conducted because antibiotic discs were unavailable. Moreover, the minimum fetal viability age was 28 weeks of pregnancy. The findings of this study suggest that early detection of lower genital tract infections and aggressive treatment may improve the outcome of PPROM in women who are at risk of developing it.

Conclusion

A complete understanding of fetal membrane processes requires more research. For the conservative treatment of PPROM ,cefixime, cefuroxime, ceftriaxone, and ampicillin-sulbactam. However, erythromycin cannot be taken in parenteral form and ceftriaxone cannot be taken orally. It recommends combining these antibiotics with metronidazole intravenously for 48 hours, followed by oral administration for 7 days. In some cases, it may be useful when there is an inadequate PPROM facilities or while waiting for culture and sensitivity results. To prevent antimicrobial resistance and antibiotic abuse, it is imperative that these findings are reviewed on a periodic basis.

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