Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 24s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Bacterial Profile and Antibiotic Sensitivity in Pregnant Women with Premature Rupture of Membranes

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Cite this paper as: Evelyn Natasya Lotisna, St. Maisuri T. Chalid, Rina Previana, Firdaus Hamid, Isharyah Sunarno, Elizabet C. Jusuf, (2025) Bacterial Profile and Antibiotic Sensitivity in Pregnant Women with Premature Rupture of Membranes. *Journal of Neonatal Surgery*, 14 (24s), 693-705.

ABSTRACT

Background: Premature Rupture of Membranes (PROM) is a significant obstetric complication that increases the risk of maternal and neonatal infections. Identifying the bacterial profile and their antibiotic sensitivity is crucial for effective management and treatment.

Objective: This study aims to determine the bacterial profile and antibiotic sensitivity patterns in pregnant women with PROM.

Methods: This analytical observational study used a prospective cross-sectional design. Urine samples were collected from pregnant women diagnosed with PROM at the Educational Network Hospital, Department of Obstetrics and Gynecology, Faculty of Medicine, Hasanuddin University, from January to June 2024. Bacterial identification and antibiotic susceptibility testing were performed using standard microbiological techniques. Data were analyzed using univariate and bivariate methods, with *SPSS* ver. 25.

Results: The most commonly isolated bacterium was Escherichia coli, followed by Enterobacter cloacae ssp. cloacae, Enterococcus faecalis, Staphylococcus haemolyticus, Aeromonas hydrophila/caviae, Enterococcus faecium, Pseudomonas aeruginosa, and Streptococcus agalactiae. Antibiotic sensitivity analysis revealed that Ciprofloxacin and Tigecycline had the highest effectiveness against the identified bacteria, with E. coli showing significant sensitivity to Cefazolin. The highest antibiotic resistance was observed in the cephalosporin group.

Conclusion: The bacterial profile in urine samples can serve as a marker for PROM risk and aid in the selection of appropriate antibiotic therapy. The use of Ciprofloxacin, Tigecycline, and Cefazolin is recommended for managing bacterial infections in PROM cases. Early detection and targeted antibiotic therapy may help prevent complications and improve maternal and neonatal outcomes.

Keywords: *Premature Rupture of Membranes, Bacterial Profile, Antibiotic Sensitivity, Pregnant Women, Urinary Tract Infection*

1. INTRODUCTION

Premature rupture of membranes (PROM) refers to the spontaneous rupture of the fetal membranes before the onset of labor. These membranes serve as a critical protective barrier for the fetus against microbial invasion. Under physiological conditions, the membranes undergo biochemical changes near term such as collagen degradation and apoptosis that eventually lead to rupture during labor. However, when this occurs prior to labor onset, it is classified as PROM and represents a significant risk for adverse maternal and neonatal outcomes. (Jena et al., 2022)

Globally, PROM affects approximately 1–4% of pregnancies (Jena et al., 2022), while in Indonesia, its prevalence is estimated at 5.6% (Ministry of Health, 2018). Known risk factors for PROM include low socioeconomic status, anemia, urinary and genital tract infections, a prior history of PROM, multiple pregnancies, and polyhydramnios (Addisu, Melkie and Blue, 2020; Abebe Diriba, Geda and Jabessa wayessa, 2022). Of these, urinary tract infections (UTIs) are particularly concerning due to their anatomical proximity and potential to cause ascending infections that may compromise membrane integrity.

Multiple studies have confirmed the association between UTIs and PROM (Byonanuwe et al., 2019; Nurfaizah, Silvana and Dwiryanti, 2020). Uropathogens may ascend from the lower genital tract and produce inflammatory mediators and enzymes

such as collagenase and phospholipase, which degrade the extracellular matrix of the membranes. These changes result in mechanical weakening and premature rupture (Byonanuwe et al., 2019). Although vaginal and cervical cultures have traditionally been used to assess microbial colonization in PROM, urine culture presents a non-invasive and easily accessible alternative, particularly in resource-limited settings (Liang et al., 2019).

Despite the established connection between infection and PROM, limited research has focused on characterizing the urinary bacterial profile in PROM patients. Moreover, current data on antimicrobial resistance patterns in this specific population remain scarce. Therefore, this study aimed to determine the urinary bacterial profile and antibiotic susceptibility patterns in pregnant women diagnosed with PROM, with the goal of informing appropriate empirical treatment and improving perinatal outcomes.

2. MATERIALS AND METHODS

This study is an analytical observational study with a prospective cross-sectional design. The research was conducted at the Educational Network Hospital, Department of Obstetrics and Gynecology, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia. The study period was from January 2024 to June 2024. The study population consisted of pregnant women diagnosed with Premature Rupture of Membranes (PROM) who sought medical care at the Educational Network Hospital, Department of Obstetrics and Gynecology, Faculty of Medicine, Hasanuddin University during the study period. Patient Characteristics demographic data, gestational age, obstetric history, and clinical presentation. Bacterial Isolation and Identification samples were collected from the amniotic fluid or cervicovaginal secretions and analyzed using microbiological culture and biochemical tests to determine bacterial species. Antibiotic Sensitivity Testing bacterial isolates were subjected to antimicrobial susceptibility testing (AST) using the Kirby-Bauer disk diffusion method, following Clinical and Laboratory Standards Institute (CLSI) guidelines. Univariate Analysis conducted to describe the frequency and percentage of patient characteristics, bacterial isolates, and antibiotic sensitivity patterns. Bivariate Analysis performed using the Chi-square test to assess the relationship between categorical variables. A p-value < 0.05 was considered statistically significant. Prior to the commencement of the study, ethical approval was obtained from the Biomedical Research Ethics Commission in Humans, Faculty of Medicine, Hasanuddin University, Makassar, under recommendation number 65/UN4.6.4.5.31/PP36/2024. Written informed consent was obtained from all participants after they received a detailed explanation of the study's objectives, benefits, and procedures. The study ensured that participants did not experience any harm, and their identities were kept confidential. No data were published without the explicit consent of the research subjects.

3. RESULTS

Table 1. Relationship between respondent characteristics and germ patterns

Variable	Germ pattern		p
	Positive n=16	Negative n=34	
Age			
<20 years	7 (43.8%)	12 (35.3%)	0.921
20-35 years old	6 (37.5%)	16 (47.1%)	
≥35 years	3 (18.7%)	6 (17.6%)	
Gestational age			
Aterm	11 (68.8%)	13 (38.2%)	0.044
Preterm	5 (31.2%)	21 (61.8%)	
IMT			
Underweight	9 (56.2%)	3 (8.8%)	0.001
Usual	4 (25%)	23 (67.6%)	
Overweight	2 (12.5%)	7 (20.6%)	

Obesity	1 (6.3%)	1 (3%)	
Parity			
Nulliparous	2 (12.5%)	18 (52.9%)	0.009
Primiparrous	8 (50%)	12 (35.3%)	
Multiparrous	6 (37.5%)	4 (11.8%)	
Education			
<9 years	14 (87.5%)	9 (26.5%)	<0.001
≥9 years	2 (12.5%)	25 (73.5%)	
Leucorea			
Yes	13 (81.3%)	1 (3%)	<0.001
Not	3 (18.7%)	33 (97%)	
Risk factors			
History of PROM			
Yes	7 (43.8%)	4 (11.8%)	0.024
Not	9 (56.2%)	30 (88.2%)	
History of UTI			
Yes	6 (37.5%)	1 (3%)	0.003
Not	10 (62.5%)	33 (97%)	
Work			
Work	2 (12.5%)	0 (0%)	N/A
Not working	14 (87.5%)	34 (100%)	

In Table 1, the relationship between variables and germ patterns is presented. Based on age, the most germ profiles were obtained in respondents with an age of < 20 years. Meanwhile, the group that did not get the most germ patterns at the age of 25-35 years was 16 (47.1%). When viewed based on gestational age, the most germ patterns were found in aterm pregnancies, namely 13 patients (38.2%). Based on BMI, the most germ patterns were found in the underweight category, namely 9 patients (56.2%), while those that did not find the most germ patterns were found in the normal weight category, namely 23 patients (67.6%). Viewed based on parity, the most germ patterns were found in the primipara group, which was 8 patients (50%), while the group that showed no germ growth in nulipara was 18 patients (52.9%). Based on education, it was found that the most germ patterns were found in <9-year education, which was 14 patients (87.5%) and in patients with ≥9 years of education, there were 25 germ-free patterns (73.5%). Based on the leucorea group, the most germ patterns were found in 13 patients (81.3%), while the category without leucorea did not find germ patterns, namely 33 patients (97%). Based on the category of KPD history in previous pregnancies, the highest number was found in the category of no KPD history both with germs (positive) and no germs (negative), namely 9 patients (56.2%) and 30 (88.2%).

Based on the UTI history category, the highest number was found in the category without UTI history, both with germs (positive) and without germs (negative), namely 10 patients (62.5%) and 33 (97%).

Based on the occupational category, the highest number was found in the non-working category, both with germs (positive)

and without germs (negative), namely 14 patients (62.5%) and 34 (97%). In this study, I also looked at the complication factors in mothers, namely Diabetes Mellitus (DM) and Hypertension (HT). The results obtained were that the group that did not DM had the most positive and negative while the group that did not DM did not find any germ growth. The same was found in the group without a history of hypertension, where 15 patients (93.7%) experienced germ growth and 34 patients (100%) had no germ growth. Meanwhile, patients with a history of hypertension did not have any germ growth at all (0)%.

Table 2. General antibiotic sensitivity

Antibiotic	**Sensitivity n (%)**	**Intermediet n (%)**	**Resistant n (%)**	**Total n (%)**
BETA LAKTAM INHIBITOR				
PENICILLIN				
Amoxicillin	3 (0.9%)	-	2 (0.6%)	5 (1.5%)
Amoxicillin/Clavulanic Acid	3 (0.9%)	-	1 (0.3%)	4 (1.2%)
Ampicilin/Clavulanic Acid	-	-	1 (0.3%)	1 (0.3%)
Ampicillin	4 (1.2%)	-	5 (1.5%)	9 (2.7%)
Ampicillin/Sulbactam	9 (2.7%)	-	2 (0.6%)	11 (3.3%)
Azlocilin	-	-	2 (0.6%)	2 (0.6%)
Cloxacilin	-	-	1 (0.3%)	1 (0.3%)
Dicloxacilin	-	-	2 (0.6%)	2 (0.6%)
Flucloxacilin	-	-	2 (0.6%)	2 (0.6%)
Methicilin	-	-	2 (0.6%)	2 (0.6%)
Mezlocilin	-	-	2 (0.6%)	2 (0.6%)
Nafcillin	-	-	2 (0.6%)	2 (0.6%)
Oxacilin MIC	-	-	2 (0.6%)	2 (0.6%)
Oxacillin	-	-	2 (0.6%)	2 (0.6%)
Piperacillin	3 (0.9%)	-	2 (0.6%)	5 (1.5%)
Piperacillin/Tazobactam	11 (3.3%)	-	3 (0.9%)	14 (4.2%)
Ticarcilin	-	-	1 (0.3%)	1 (0.3%)
Ticarcilin/Clavulanic Acid	-	-	1 (0.3%)	1 (0.3%)
Benzylpenicillin	3 (0.9%)	-	2 (0.6%)	5 (1.5%)
CEPHALOSPORIN				
1ST Generation				
Cefalexin	-	-	2 (0.6%)	2 (0.6%)
Cefradine	-	-	2 (0.6%)	2 (0.6%)
Cefazolin	6 (1.8%)	-	5 (1.5%)	11 (3.3%)
Cephapirin	-	-	2 (0.6%)	2 (0.6%)

Antibiotic	**Sensitivity n (%)**	**Intermediet n (%)**	**Resistant n (%)**	**Total n (%)**
Cefalotin	-	-	2 (0.6%)	2 (0.6%)
2nd Generation				
Cefaclor	-	-	2 (0.6%)	2 (0.6%)
Cefmetazole	-	-	2 (0.6%)	2 (0.6%)
Cefonicid	-	-	2 (0.6%)	2 (0.6%)
Cefotetan	-	-	2 (0.6%)	2 (0.6%)
Cefoxitin	-	-	4 (1.2%)	4 (1.2%)
Cefprozil	-	-	2 (0.6%)	2 (0.6%)
Cefuroxime	-	-	2 (0.6%)	2 (0.6%)
Loracarbef	-	-	2 (0.6%)	2 (0.6%)
Cefamandole	-	-	2 (0.6%)	2 (0.6%)
3rd Generation				
Cefofexin	-	-	1 (0.3%)	1 (0.3%)
Cefpodoxime	-	-	2 (0.6%)	2 (0.6%)
Cefoperazone	-	-	2 (0.6%)	2 (0.6%)
Cefotaxime	-	-	1 (0.3%)	1 (0.3%)
Ceftazidime	9 (2.7%)	-	3 (0.9%)	12 (3.6%)
Cefovecin	-	-	1 (0.3%)	1 (0.3%)
Ceftizoxime	-	-	2 (0.6%)	2 (0.6%)
Ceftriaxone	9 (2.7%)	-	3 (0.9%)	12 (3.6%)
Cefdinir	-	-	2 (0.6%)	2 (0.6%)
Cefditoren	-	-	2 (0.6%)	2 (0.6%)
Cefetamet	-	-	2 (0.6%)	2 (0.6%)
Cefixime	-	-	2 (0.6%)	2 (0.6%)
Cefmenoxim	-	-	2 (0.6%)	2 (0.6%)
Ceftibuten	-	-	2 (0.6%)	2 (0.6%)
4th Generation				
Cefpirome	-	-	2 (0.6%)	2 (0.6%)
Cefepime	10 (3%)	-	2 (0.6%)	12 (3.6%)
MONOBACTAM				
Aztreonam	9 (2.7%)	-	1 (0.3%)	10 (3%)
CARBAPENEM				

Antibiotic	Sensitivity n (%)	Intermediet n (%)	Resistant n (%)	Total n (%)
Doripenem	-	-	2 (0.6%)	2 (0.6%)
Ertapenem	8 (2.4%)	-	3 (0.3%)	11 (3.3%)
Faropenem	-	-	2 (0.6%)	2 (0.6%)
Imipenem	2 (0.6%)	-	2 (0.6%)	4 (1.2%)
MACROLIDE				
Clarithromycin	1 (0.3%)	-	1 (0.3%)	2 (0.6%)
Erythromycin	1 (0.3%)	3 (0.3%)	1 (0.3%)	5 (1.5%)
Azithromycin	1 (0.3%)	-	1 (0.3%)	2 (0.6%)
Meropenem	10 (3%)	-	2 (0.6%)	12 (3.6%)
NO LACTAM				
OTHER				
Flomoxef	-	-	2 (0.6%)	2 (0.6%)
Latamoxef	-	-	2 (0.6%)	2 (0.6%)
SINTESIS PROTEIN				
AMINOGLICOSIDE				
Amikacin	10 (3%)	-	1 (0.3%)	10 (3%)
Gentamicin	12 (3.6%)	-	1 (0.3%)	13 (3.9%)
Streptomicin	1 (0.3%)	-	-	1 (0.3%)
TETRACYCLINE				
Tetracycline	3 (0.9%)	-	1 (0.3%)	4 (1.2%)
Doxycycline	3 (0.3%)	-	-	3 (0.3%)
Minocycline	3 (0.9%)	-	-	3 (0.9%)
Tigecycline	13 (3.9%)	-	1 (0.3%)	14 (4.2%)
OXAZOLIDONONES				
Linezolid	5 (1.5%)	-	-	5 (1.5%)
STREPTOGRAMINS				
Quinupristin/Dalfopristin	2 (0.6%)	-	2 (0.6%)	4 (1.2%)
LINCOSAMIDE				
Clindamycin	1 (0.3%)	-	1 (0.3%)	2 (0.6%)
FLUOROQUINOLON				
Ciprofloxacin	13 (3.9%)	-	1 (0.3%)	14 (4.2%)

Antibiotic	Sensitivity n (%)	Intermediet n (%)	Resistant n (%)	Total n (%)
Levofloxacin	3 (0.9%)	-	1 (0.3%)	4 (1.2%)
Moxifloxacin	2 (0.6%)	-	1 (0.3%)	3 (0.9%)
Ofloxacin	1 (0.3%)	-	-	1 (0.3%)
NITROFURAN				
Nitrofurantoin	11 (3.3%)	4 (1.2%)	-	15 (4.5%)
mRNA Synth				
Rifampicin	2 (0.6%)	-	-	2 (0.6%)
DHFR INHIBITOR				
Trimethoprim/Sulfamethoxazole	5 (1.5%)	-	6 (1.8%)	11 (3.3%)
Total	192 (57.1%)	7 (2.1%)	137 (40.8%)	336 (100%)

Table 2 presents the antibiotic sensitivity profiles of bacterial isolates obtained from pregnant women with Premature Rupture of Membranes (PROM). The table categorizes bacterial responses to various antibiotics into three groups: sensitive (S), intermediate (I), and resistant (R). The findings highlight significant variations in antibiotic efficacy, with some bacterial strains demonstrating high sensitivity to specific antibiotics, while others exhibit intermediate responses or complete resistance. Broad-spectrum antibiotics such as carbapenems and third-generation cephalosporins tend to show higher sensitivity rates, suggesting their potential effectiveness in treating infections associated with PROM. In contrast, certain bacterial isolates demonstrate resistance to commonly used antibiotics like penicillins and first-generation cephalosporins, raising concerns about antimicrobial resistance (AMR) and the need for careful antibiotic selection. The presence of intermediate susceptibility in some bacterial isolates indicates that higher doses or combination therapy may be required for effective treatment. The increasing resistance observed in some pathogens, particularly against beta-lactam antibiotics, underscores the necessity of routine bacterial culture and susceptibility testing before initiating empirical treatment. These findings emphasize the importance of antibiotic stewardship programs to prevent the misuse of antibiotics and reduce the risk of treatment failure. Clinicians should tailor antibiotic therapy based on local resistance patterns to ensure optimal maternal and neonatal outcomes. Further research is needed to monitor resistance trends over time and develop updated guidelines for managing infections in PROM cases.

Table 3. Group. Bacterial Culture and Antibiotic Sensitivity

Bacteria	Grams	Antibiotic
Enterococus faecalis	Positive	Benzylpenicillin, Amoxicillin, Ampicillin, Amoxicillin/Clavulanic, Amipiclin/Sulbactam, Piperacillin, Imipenem, Gentamicin, Streptomicin, Ciprofloxacin, Levofloxacin, Linezolid, Doxycycline, Minocycline, Tetracycline, Tigecycline, Nitrofurantoin
Staphylococcus haemolyticus	Positive	Quinupristin/Dalfopristin, Linezolid, Doxycline, Minocycline, Tetracycline, Tigecycline, Nitrofurantoin, Rifampicin
Streptococcus agalactiae	Positive	Linezolid, Moxifloxacin, Tigecycline, Nitrofurantoin

Staphilococcus haemolyticus	Positive	Gentamicin, Ciprofloxacin, Levofloxacin, Moxifloxacin, Ofloxacin, Azithromycin, Clartihromycin, Erythromycin, Clindamycin, Quinupristin/Dalfopristin, Linezolid, Doxycycline, Minocycline, Tetracycline, Tigecycline, Nitrofurantoin, Rifampicin, Trimethoprim/Sulfamethoxazole
Enterococcus faecium	Positive	Benzylpenicillin, Amoxicillin, Amoxicillin/Clavulanic Acid, Ampicillin/Sulbactam, Piperacillin, Piperacillin/Tazobactam
Escheria coli	Negative	Ampicillin, Ampicillin/Sulbactam, Piperacillin/Tazobactam, Cefazolin, Ceftazidime, Ceftriaxone, Cefepime, Aztreonam, Ertapenem, Meropenem, Amikacin, Gentamicin, Ciprofloxacin, Tigecycline, Nitrofurantoin, Trimethoprim/Sulfamethoxazole
Enterobacter cloacae ssp cloacae	Negative	Piperacillin/Tazobactam, Ceftazidime, Ceftriaxone, Cefepime, Aztreonam, Ertapenem, Meropenem, Amikacin, Gentamicin, Ciprofloxacin, Tigecycline, Trimethoprim/Sulfamethoxazole
Aeromonas hydrophila/caviae	Negative	Piperacillin/Tazobactam, Ceftazidime, Ceftriaxone, Cefepime, Aztreonam, Ertapenem, Meropenem, Amikacin, Gentamicin, Ciprofloxacin, Tigecycline, Trimethoprim/Sulfamethoxazole
Pseudomonas aeruginosa	Negative	Piperacillin/Tazobactam, Ceftazidime, Ceftriaxone, Cefepime, Aztreonam, Meropenem, Amikacin, Gentamicin, Ciprofloxacin

Table 3 illustrates the antibiotic sensitivity patterns of bacterial isolates obtained from pregnant women with Premature Rupture of Membranes (PROM). The results indicate that the highest antibiotic sensitivity was observed in the penicillin class, with 36 antibiotics (10.7%) demonstrating effectiveness against the tested bacterial strains. This finding suggests that, despite concerns about resistance, certain penicillin-based antibiotics may still be viable treatment options for some infections associated with PROM. In contrast, antibiotics classified under the nitrofuran group exhibited the highest percentage of intermediate susceptibility, with 4 antibiotics (1.2%) showing a moderate effect. This intermediate response implies that bacterial isolates might require higher dosages or combination therapy for effective eradication.The study highlights a significant resistance trend within the cephalosporin group, where 64 antibiotics (19.1%) exhibited resistance. This finding raises concerns about antimicrobial resistance (AMR), particularly regarding the widespread use of cephalosporins in obstetric and gynecological infections. The high resistance rate may suggest prior overuse or misuse of these antibiotics, necessitating a re-evaluation of empirical treatment guidelines for PROM cases. These results underscore the importance of conducting regular antibiotic susceptibility testing to ensure the selection of the most effective antimicrobial agents, ultimately reducing the risk of treatment failure and improving maternal and neonatal outcomes.

4. DISCUSSION

This study demonstrated that 32% of urine samples from PROM patients were culture-positive, with Escherichia coli being the predominant isolate. This aligns with prior studies identifying E. coli as a leading uropathogen during pregnancy, often associated with ascending infections and PROM. Studies by Jiménez-Escutia et al. (2023) and Soto et al. (2018) confirmed E. coli's ability to disrupt the choriodecidual barrier and activate inflammation contributing to membrane rupture.

Antibiotic susceptibility testing in our study revealed substantial resistance to cephalosporins, while Ciprofloxacin and Tigecycline showed high effectiveness, especially against Gram-negative isolates such as E. coli and Enterobacter spp. These results are consistent with reports from WHO (2022) on global antimicrobial resistance trends and echo findings by Balachandran et al. (2022) and Rosana et al. (2020), which demonstrated rising resistance to beta-lactam antibiotics in

obstetric populations.

Sociodemographic factors, including underweight status, low education, and primiparity, were significantly associated with the presence of bacterial growth. These findings suggest a multifactorial etiology of PROM involving host vulnerability, hygiene practices, and potentially modifiable behaviors. They support previous analyses by Liu et al. (2022) and Zhang et al. (2024), which link maternal nutritional status and vaginal microbiota shifts to PROM risk.

The strengths of this study lie in its prospective design, culture-based diagnosis, and correlation with maternal factors. However, it is limited by its modest sample size, use of urine rather than cervicovaginal or amniotic fluid samples, and lack of molecular diagnostics such as PCR or 16S rRNA sequencing. These limitations may underestimate the presence of fastidious organisms or biofilm-associated bacteria.

Clinically, this study underscores the importance of early detection and targeted antimicrobial therapy in PROM cases. Empirical treatment should be guided by local antibiograms, and routine urine culture screening could serve as a non-invasive tool for infection risk stratification. Further studies with larger cohorts and advanced microbial techniques are recommended to refine diagnostic and therapeutic strategies in PROM.

Premature rupture of membranes (PROM) refers to the spontaneous rupture of the fetal membranes before the onset of labor (Tiruye et al., 2021a). The fetal membranes play a crucial role in shielding the fetus from microbial invasion within the uterine cavity. At term, a combination of mechanical stress, collagen degradation, and apoptosis weakens the membrane, leading to its rupture (Michael & Senior, 2021; Abebe Diriba, Geda, & Jabessa Wayessa, 2022). When this occurs prior to labor onset, it is defined as PROM, and it can significantly increase the risk of maternal and neonatal complications (Enjamo et al., 2022).

Globally, the incidence of PROM is estimated to range between 1–4% of pregnancies, while in Indonesia it is reported at 5.6% (Ministry of Health, 2018). Various risk factors have been associated with PROM, including low socioeconomic status, anemia, urinary and genital tract infections, previous PROM, multiple gestations, and polyhydramnios (Addisu, Melkie dan Biru, 2020; Abebe Diriba, Geda dan Jabessa Wayessa, 2022). Among these, urinary tract infections (UTIs) have drawn particular attention due to their anatomical proximity and potential for ascending infection (Paari et al., 2017).

Numerous studies have established a link between UTIs and PROM. Uropathogens may ascend from the lower genital tract, causing inflammation, enzymatic degradation of collagen, and release of prostaglandins, all contributing to membrane weakening (Michael & Senior, 2021; Abebe Diriba, Geda, & Jabessa Wayessa, 2022). Moreover, UTIs can serve as a reservoir for pathogens implicated in intrauterine infections, including Escherichia coli, Group B Streptococcus, and Enterococcus spp (Pandey, 2018; Habak & Griggs, 2022). Despite this, limited research has explored the urinary bacterial profile specifically among women with PROM. While vaginal and cervical cultures have often been used to identify pathogens associated with PROM, urine samples represent a non-invasive and accessible diagnostic specimen (Liang et al., 2019). Establishing the bacterial profile and corresponding antibiotic susceptibility patterns in this population is essential for guiding empirical treatment and preventing adverse outcomes. Therefore, this study aims to investigate the bacterial profile and antibiotic resistance patterns in urine samples from pregnant women diagnosed with PROM at a tertiary hospital in Indonesia.

A total of 50 pregnant women diagnosed with PROM were enrolled in this study. Bacterial growth was detected in 16 urine samples (32%), while the remaining 34 samples (68%) showed no microbial growth. The most frequently isolated microorganism was Escherichia coli, followed by Enterobacter cloacae ssp. cloacae, Enterococcus faecalis, Staphylococcus haemolyticus, Aeromonas hydrophila/caviae, Enterococcus faecium, Pseudomonas aeruginosa, and Streptococcus agalactiae.

Statistical analysis revealed significant associations between bacterial presence and several maternal characteristics. A higher prevalence of bacterial growth was observed in participants who were underweight ($p = 0.001$), primiparous ($p = 0.009$), had low educational attainment (<9 years, $p < 0.001$), reported abnormal vaginal discharge ($p < 0.001$), or had a history of urinary tract infections ($p = 0.003$). Bacterial colonization was also significantly more common among those with a history of PROM in previous pregnancies ($p = 0.024$) and those with term gestation ($p = 0.044$). Antibiotic susceptibility testing indicated that Ciprofloxacin, Tigecycline, and Nitrofurantoin exhibited high efficacy against most Gram-negative isolates. Escherichia coli, the predominant isolate, showed notable sensitivity to Cefazolin. However, a high degree of resistance was observed against first- and third-generation cephalosporins, suggesting widespread beta-lactam resistance. These findings highlight the need for routine microbiological screening and antibiotic susceptibility testing in PROM cases to guide effective and individualized treatment strategies.

This study highlights the presence of uropathogenic bacteria in a significant proportion of pregnant women with PROM, with Escherichia coli being the most frequently isolated organism. The findings reinforce the role of urinary tract colonization as a potential contributor to membrane rupture and suggest that urine bacterial profiling may serve as a valuable early marker for infection risk in PROM cases. Antibiotic sensitivity testing revealed that Ciprofloxacin, Tigecycline, and Cefazolin remain effective options against the predominant bacterial strains. However, the observed resistance to cephalosporins

underscores the urgency of routine culture-based diagnostics and antimicrobial stewardship to combat emerging resistance trends. In clinical practice, the integration of targeted microbiological screening and tailored antibiotic therapy can improve infection control and reduce maternal and neonatal complications associated with PROM. Further research involving larger cohorts and advanced microbiota analysis techniques is warranted to validate these findings and inform future clinical guidelines.

5. CONCLUSION

The findings of this study indicate that Escherichia coli is the dominant bacterial species identified in the urine samples of pregnant women with Premature Rupture of Membranes (PROM). In addition to E. coli, other bacterial isolates detected include Enterobacter cloacae ssp. cloacae, Enterococcus faecalis, Staphylococcus haemolyticus, Aeromonas hydrophila/caviae, Enterococcus faecium, Pseudomonas aeruginosa, and Streptococcus agalactiae. Antibiotic sensitivity testing revealed that Ciprofloxacin and Tigecycline exhibited the highest effectiveness against most isolated bacterial strains. Additionally, E. coli demonstrated significant susceptibility to Cefazolin, making it a potentially suitable treatment option for infections in PROM cases. These results highlight the importance of urine bacterial profiling as a potential marker for PROM risk and provide guidance for antibiotic therapy selection. The findings support the use of Ciprofloxacin, Tigecycline, and Cefazolin as recommended antibiotics to manage bacterial infections in pregnant women with PROM. Early identification of bacterial colonization and appropriate antimicrobial therapy may help in preventing complications associated with PROM, ultimately improving maternal and neonatal health outcomes. Further research and continuous antibiotic resistance surveillance are necessary to ensure the effectiveness of recommended treatment strategies over time.

6. ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to the Department of Obstetrics and Gynecology, Faculty of Medicine, Hasanuddin University, for their valuable support and collaboration throughout this research. We also extend our appreciation to the Educational Network Hospital for providing the necessary facilities and access to patient data, which made this study possible. We acknowledge the Biomedical Research Ethics Commission of the Faculty of Medicine, Hasanuddin University, for their ethical approval and guidance in ensuring compliance with research standards. Lastly, our deepest thanks go to all the patients who participated in this study and to the laboratory staff for their assistance in sample collection and bacterial analysis.

Conflict of Interest

The authors declare that there is no conflict of interest related to this study. The research was conducted independently, without any influence from pharmaceutical companies, funding bodies, or other external organizations that could affect the objectivity of the results and conclusions.

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