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RESEARCH ARTICLE

# Determinants and Outcomes of Expectant Management in Preterm Premature Rupture of Membranes: A Prospective Observational Study

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Abstract: ***Background:*** Preterm premature rupture of membranes (PPROM) is a significant contributor to perinatal morbidity and mortality. This study evaluates risk factors, clinical presentation, and outcomes of expectant management in antenatal women with PPROM between 28 and 37 weeks of gestation. ***Methods:*** A prospective observational study was conducted at Saveetha Medical College from January 2023 to March 2024. Twenty-one antenatal women with singleton pregnancies complicated by PPROM were enrolled. Clinical, microbiological, and neonatal outcomes were assessed. Data were analyzed using SPSS v21, with p-values ≤0.05 considered statistically significant. ***Results:*** Most patients presented within 11 hours of membrane rupture. The most common organisms identified were E. coli, Klebsiella pneumoniae, and Pseudomonas aeruginosa. Conservative management led to favorable outcomes in early PPROM. Neonatal morbidities included jaundice and birth asphyxia (12% each), and one stillbirth was recorded. Chorioamnionitis and urinary tract infections were key maternal complications. ***Conclusion:*** Expectant management in stable early PPROM cases, supported by antibiotics and corticosteroids, can lead to improved neonatal outcomes. However, strict monitoring is vital to detect complications such as chorioamnionitis.

Keywords: PPROM, Preterm labor, Neonatal outcome, Expectant management, Chorioamnionitis.

## INTRODUCTION

Preterm premature rupture of membranes (PPROM) refers to the spontaneous rupture of fetal membranes before the onset of labor and prior to 37 weeks of gestation. It affects approximately 3% of all pregnancies and accounts for nearly one-third of preterm births, thus posing significant challenges in obstetric care due to associated maternal and neonatal risks [1].

The etiology of PPROM is multifactorial. Established risk factors include a history of preterm birth, low maternal body mass index, smoking, infections, multiple gestation, and invasive prenatal procedures [2]. The integrity of fetal membranes can be compromised by both mechanical and inflammatory processes, leading to premature rupture.

Neonatal outcomes in PPROM are heavily influenced by gestational age at rupture and delivery. Preterm birth exposes neonates to complications such as respiratory distress syndrome, intraventricular hemorrhage, necrotizing enterocolitis, and long-term neurodevelopmental delays [3,4]. Maternal complications such as chorioamnionitis, placental abruption, and sepsis further complicate the clinical picture [5].

Management strategies for PPROM depend on gestational age, signs of infection, and fetal status. In pregnancies less than 34 weeks, expectant management with antibiotics, corticosteroids, and close monitoring is generally recommended [6]. Delivery is usually indicated beyond 34 weeks or if signs of chorioamnionitis or fetal compromise are present.

This study was conducted to evaluate the risk factors and effectiveness of expectant management in PPROM cases at a tertiary care center in India, with a focus on maternal and neonatal outcomes.

**Aims and Objectives**

- To identify common risk factors associated with PPROM.
- To evaluate the outcomes of expectant management in pregnancies complicated by PPROM.
- To assess both maternal and neonatal morbidity and mortality associated with PPROM.

## MATERIALS AND METHODS

This prospective observational study was conducted at the Department of Obstetrics and Gynaecology, Saveetha Medical College Hospital, Chennai, from January 2023 to March 2024. The study enrolled antenatal women diagnosed with preterm premature rupture of membranes (PPROM) between 28 and 37 weeks of gestation. A total of 21 eligible participants were included based on predefined inclusion and exclusion criteria.

Inclusion criteria comprised pregnant women carrying a singleton fetus, with a gestational age ranging from 28 to 37 weeks, and a diagnosis of PPROM confirmed through a combination of clinical and investigative modalities.

Diagnosis was established via sterile speculum examination demonstrating amniotic fluid leakage, a positive pad test, and supporting findings from obstetric ultrasonography. Exclusion criteria were stringently applied to eliminate confounding clinical conditions. Patients with hypertensive disorders of pregnancy, gestational or pregestational diabetes mellitus, fetal growth restriction, uterine anomalies, congenital fetal malformations, fibroid uterus, antepartum hemorrhage, and multiple pregnancies were excluded. Additionally, those with chronic systemic illnesses such as cardiac disease or chronic renal failure were not included in the study cohort.

Detailed demographic and clinical histories were recorded at admission. The diagnostic workup included routine hematological investigations, urine analysis, and high vaginal swab cultures to identify possible infectious agents. Continuous fetal monitoring was implemented using cardiotocography (CTG), and obstetric ultrasonography was performed to determine gestational age, fetal biometry, presentation, amniotic fluid index, and to rule out structural anomalies.

The management strategy was tailored according to gestational age and maternal-fetal status. Women presenting with PPROM before 34 weeks of gestation were managed conservatively with hospital admission, administration of prophylactic antibiotics to reduce the risk of ascending infection, and antenatal corticosteroids to enhance fetal lung maturity. Labor was allowed to proceed spontaneously unless clinical indicators necessitated intervention. For cases at or beyond 34 weeks of gestation, induction of labor was performed in the absence of spontaneous onset to mitigate risks associated with prolonged membrane rupture. Vigilant monitoring for signs of chorioamnionitis was undertaken throughout hospitalization and included maternal temperature, pulse, uterine tenderness, and assessment of amniotic fluid characteristics. Fetal surveillance was maintained through repeated CTG assessments.

Delivery outcomes, both maternal and neonatal, were systematically documented. Neonatal status was assessed immediately postpartum, and any adverse outcomes such as jaundice, birth asphyxia, or sepsis warranted admission to the neonatal intensive care unit (NICU). Postnatal follow-up for mothers and neonates was conducted for a period of six weeks to capture late-onset complications and overall recovery.

Statistical analysis of the collected data was carried out using SPSS version 21. Descriptive statistics were applied for baseline characteristics, while inferential statistics were employed to evaluate associations between variables. A p-value of ≤0.05 was considered statistically significant for determining the strength of associations in clinical outcomes.

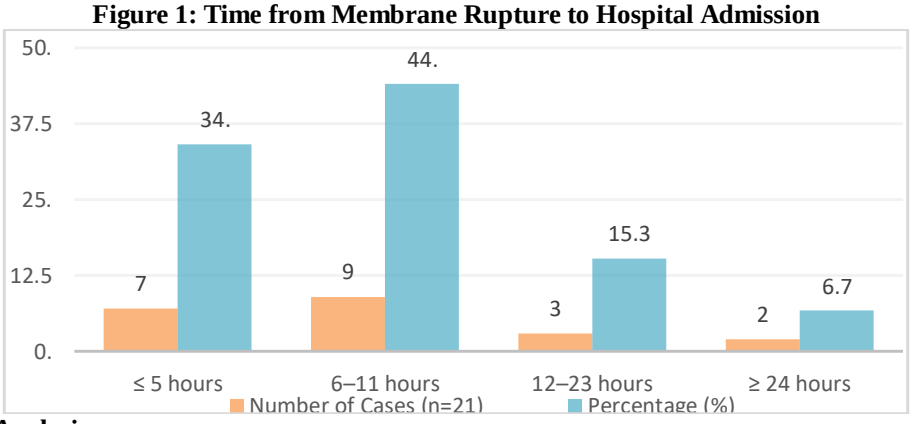
# RESULTS AND OBSERVATIONS:

In this prospective observational study, 21 antenatal women with preterm premature rupture of membranes (PPROM) were evaluated. The demographic analysis revealed that most participants (44%) presented to the hospital within 6–11 hours of membrane rupture, while 34% reported within the first five hours. A smaller proportion (15.33%) were admitted between 12–23 hours, and 6.67% presented after 24 hours of rupture.

**Table 1: Time from Membrane Rupture to Hospital Admission**

| Time Interval Post-Rupture | Number of Cases (n=21) | Percentage (%) |
|---|---|---|
| ≤ 5 hours | 7 | 34.00 |
| 6–11 hours | 9 | 44.00 |
| 12–23 hours | 3 | 15.33 |
| ≥ 24 hours | 2 | 6.67 |

**Figure 1: Time from Membrane Rupture to Hospital Admission**



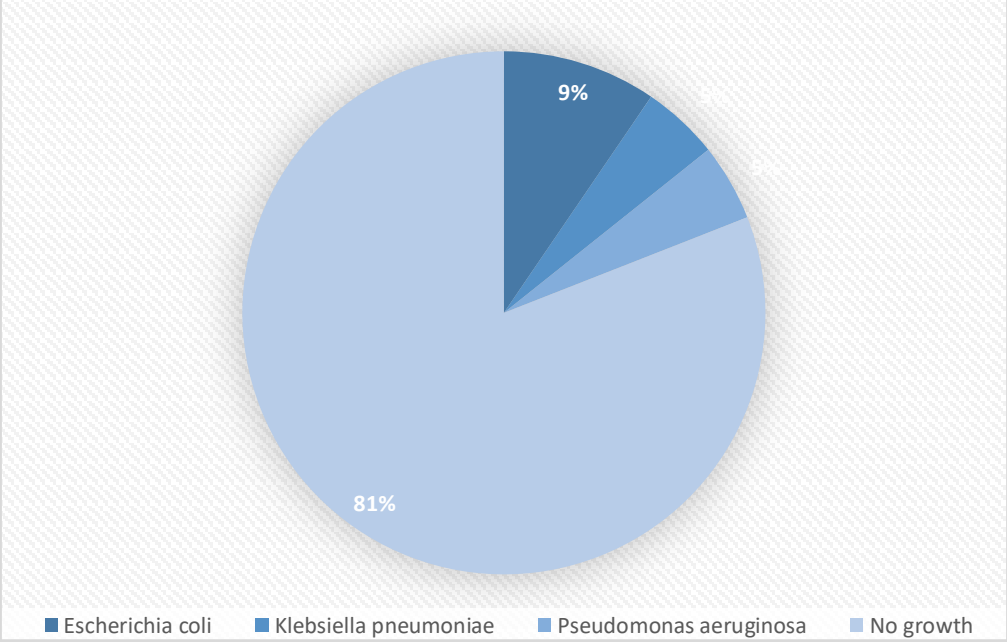

**Microbiological Analysis**

High vaginal swab (HVS) culture results showed that **Escherichia coli** was the predominant organism, identified in 9% of cases, followed by **Klebsiella pneumoniae** (5%) and **Pseudomonas aeruginosa** (5%). However, 82% of cultures revealed no significant microbial growth.

**Table 2: High Vaginal Swab Culture Results**

| Organism | Number of Cases | Percentage (%) |
|---|---|---|
| *Escherichia coli* | 2 | 9.00 |
| *Klebsiella pneumoniae* | 1 | 5.00 |
| *Pseudomonas aeruginosa* | 1 | 5.00 |
| No growth | 17 | 81.00 |

**Figure 2: High Vaginal Swab Culture Results**

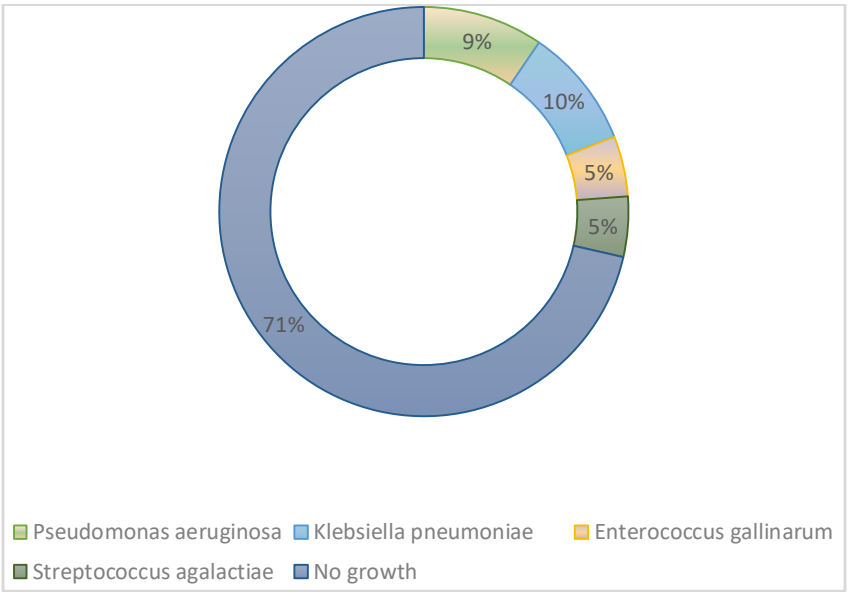



Urine cultures revealed a broader microbial spectrum. **Pseudomonas aeruginosa** (10%) and **Klebsiella pneumoniae** (9%) were frequently isolated, followed by **Enterococcus gallinarum** (5%) and **Streptococcus agalactiae** (3%). Nonetheless, 71% of urine cultures were sterile.

**Table 3: Urine Culture Results**

| Organism | Number of Cases | Percentage (%) |
|---|---|---|
| *Pseudomonas aeruginosa* | 2 | 10.00 |
| *Klebsiella pneumoniae* | 2 | 9.00 |
| *Enterococcus gallinarum* | 1 | 5.00 |
| *Streptococcus agalactiae* | 1 | 3.00 |
| No growth | 15 | 71.00 |

**Figure 3: Urine Culture Results**



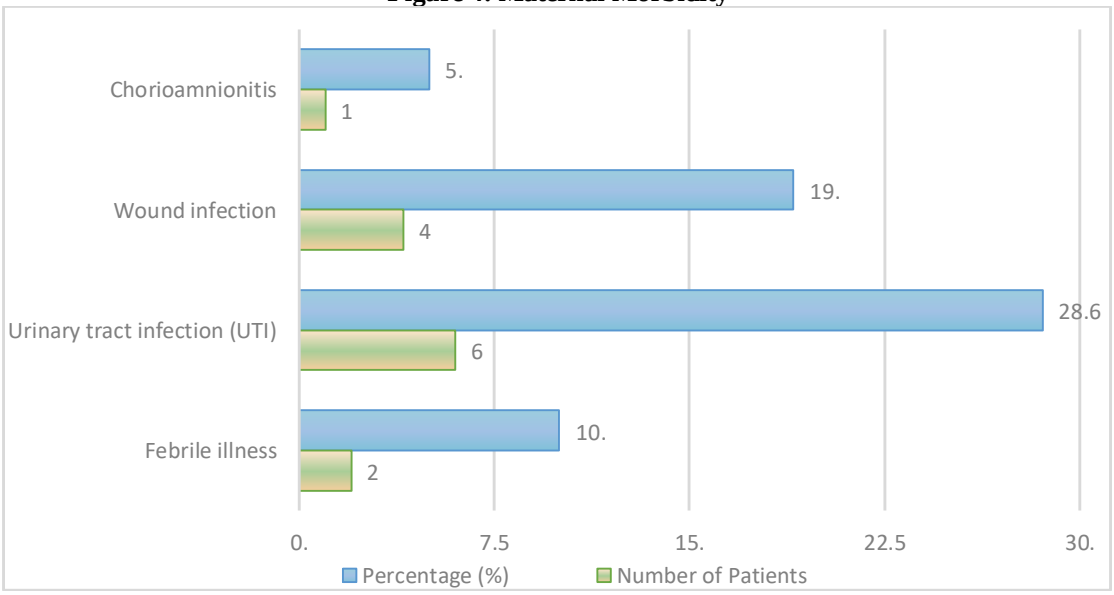

**Maternal Morbidity**

Maternal complications were observed in a notable proportion of patients. Febrile illness occurred in 10% of women, while **urinary tract infections (UTI)** were the most common morbidity, seen in 28.57% of patients. **Wound infections** developed in 19% of patients post-delivery. **Chorioamnionitis**, a significant complication of PPROM, was diagnosed in 5% of participants.

**Table 4: Maternal Morbidity**

| Complication | Number of Patients | Percentage (%) |
|---|---|---|
| Febrile illness | 2 | 10.00 |
| Urinary tract infection (UTI) | 6 | 28.57 |
| Wound infection | 4 | 19.00 |
| Chorioamnionitis | 1 | 5.00 |

**Figure 4: Maternal Morbidity**

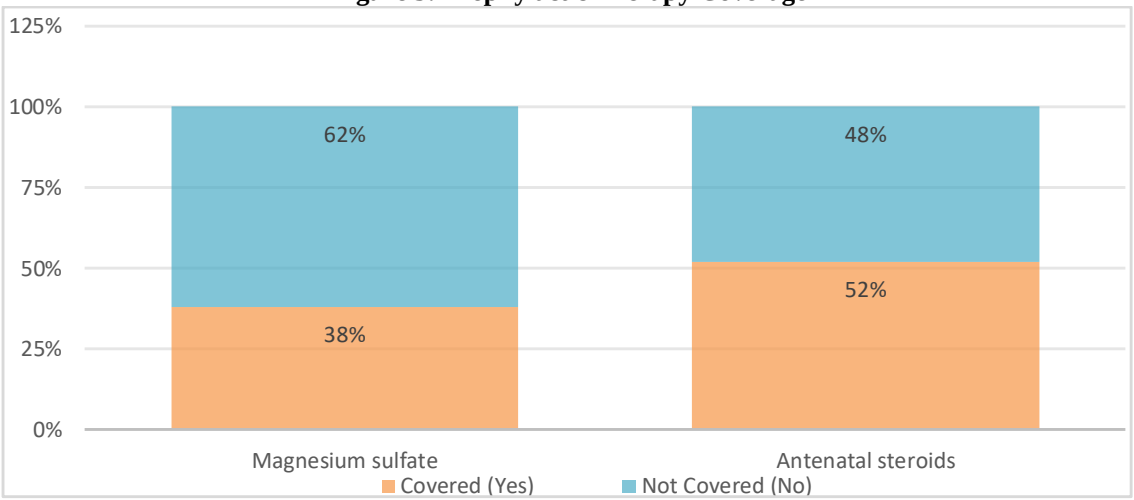



In terms of interventions, magnesium sulfate ($MgSO_4$) was administered for neuroprotection in 38% of cases, whereas antenatal corticosteroids were given to 52% of patients for fetal lung maturity.

**Table 5: Prophylactic Therapy Coverage**

| Intervention | Covered (Yes) | Not Covered (No) |
|---|---|---|
| Magnesium sulfate | 38% | 62% |
| Antenatal steroids | 52% | 48% |

**Figure 5: Prophylactic Therapy Coverage**




**Neonatal Morbidity and Mortality**

The majority of neonates (72%) were healthy at birth. However, **birth asphyxia** and **jaundice** each occurred in 12% of newborns. **Neonatal septicemia** was identified in 4.76%, and **one stillbirth** was recorded, accounting for a **4.76% neonatal mortality** rate. Birth weight distribution showed that 24% of neonates weighed less than 1.5 kg, while 48% weighed between 1.5–2.0 kg. Only 5% weighed more than 2.5 kg. **NICU admission** was required in 86% of cases, reflecting the fragility of the neonatal condition in PPROM scenarios.

**Table 6: Neonatal Outcomes**

| Outcome | Percentage (%) |
|---|---|
| Healthy | 72 |
| Birth asphyxia | 12 |
| Jaundice | 12 |
| Septicemia | 4.76 |
| NICU admission | 86 |
| Neonatal mortality (stillbirth) | 4.76 |

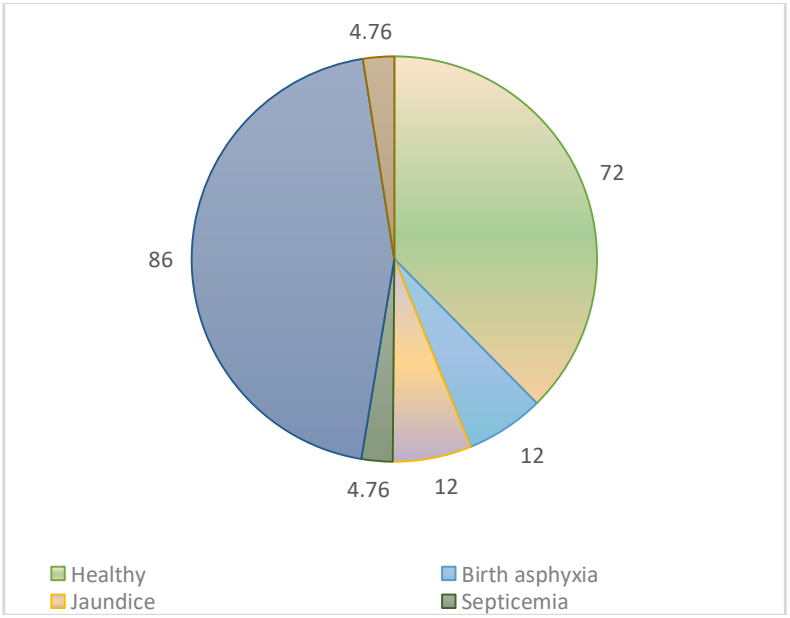
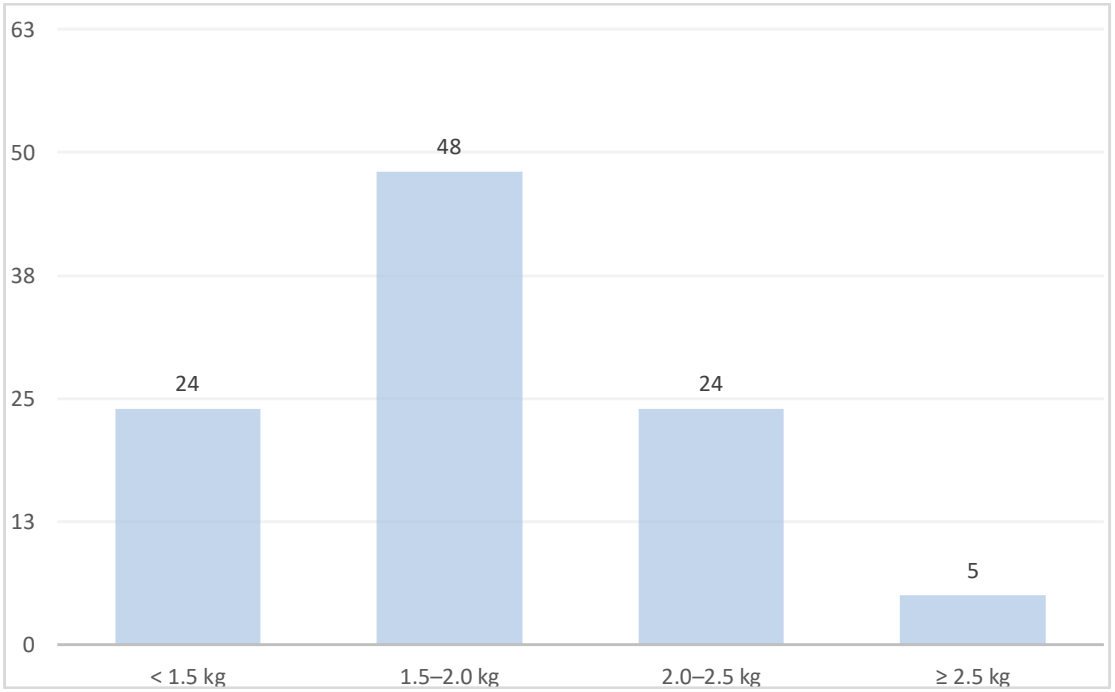



**Table 7: Birth Weight Distribution**

| Birth Weight Range | Percentage (%) |
|---|---|
| < 1.5 kg | 24 |
| 1.5–2.0 kg | 48 |
| 2.0–2.5 kg | 24 |
| ≥ 2.5 kg | 5 |




**Neonatal Morbidity Correlation and Statistical Significance**

Several clinical parameters showed statistically significant correlation with neonatal outcomes. Elevated total leukocyte count and C-reactive protein (CRP) were associated with morbidity in 90% and 43% of cases, respectively, with p-values of 0.03455 and 0.0009. Operative intervention showed a strong correlation (p = 0.0020) with adverse neonatal outcomes. NICU admission was also significantly associated with morbidity, with a p-value of 0.0006.

**Table 8: Association of Morbidity Factors with Neonatal Outcomes**

| Morbidity Factor | P-value | Percentage (%) |
|---|---|---|
| Raised total leukocyte count | **0.03455** | 90 |
| Raised C-reactive protein (CRP) | **0.0009** | 43 |
| Febrile illness and chorioamnionitis | 0.6902 | 10 |
| Operative interference | **0.0020** | 60 |
| Birth asphyxia | 0.2289 | 12 |
| Jaundice | 0.1611 | 12 |
| Septicemia | 0.6065 | 4.75 |
| NICU admission | **0.0006** | 86 |

# DISCUSSION

Preterm premature rupture of membranes (PPROM) remains a critical obstetric complication that significantly contributes to perinatal morbidity and mortality worldwide. In this study conducted at a tertiary care center in South India, we evaluated the maternal and neonatal outcomes associated with expectant management in pregnancies complicated by PPROM between 28 and 37 weeks of gestation.

The majority of women in our cohort (44%) presented to the hospital within 6–11 hours of membrane rupture, which allowed for timely initiation of management. Early hospital admission following membrane rupture is associated with better outcomes, as it permits the early administration of corticosteroids and antibiotics, as well

as monitoring for signs of infection. Similar observations were made by Simhan and Canavan, who emphasized that prompt medical attention post-rupture is critical in reducing infectious morbidity and improving neonatal survival rates [1].

Microbiological data revealed that Escherichia coli was the most frequently isolated pathogen in high vaginal swab (HVS) cultures (9%), followed by Klebsiella pneumoniae and Pseudomonas aeruginosa (5% each). These findings are consistent with a retrospective study by Bhagat et al., who found gram-negative organisms such as E. coli and Klebsiella to be the predominant pathogens in PPROM cases, correlating with increased maternal and neonatal infections [2]. In our study, 28.57% of women developed urinary tract infections (UTIs), aligning closely with previous research conducted by Kenyon et al., which identified a 30% rate of asymptomatic bacteriuria and UTI in patients with PPROM [3].

Chorioamnionitis, although limited to 5% of our population, is a major concern in expectant management. The condition significantly increases the risk of neonatal sepsis, respiratory complications, and intraventricular hemorrhage. Our findings parallel those reported by Mercer (2003), who noted that chorioamnionitis occurred in approximately 5–10% of managed PPROM cases and had a direct influence on the decision to expedite delivery [4].

In this cohort, maternal morbidity included febrile illness (10%) and wound infections (19%), both of which reflect the potential complications associated with prolonged latency. The rate of maternal infectious morbidity observed in this study is similar to that reported by Parry and Strauss, who found that up to 25% of women with PPROM may develop subclinical infections if conservative management exceeds 7 days [5].

The administration of magnesium sulfate ($MgSO_4$) for fetal neuroprotection was carried out in 38% of women, specifically those with gestational age below 34 weeks, in line with ACOG recommendations [6]. Similarly, antenatal corticosteroids were administered in 52% of cases. Corticosteroid coverage was associated with reduced incidence of respiratory distress syndrome and other neonatal complications, a finding echoed in the NICHD-MFMU Network study, which demonstrated improved neonatal survival with antenatal steroid administration [7].

Neonatal outcomes in our study showed that while 72% of newborns were healthy, 12% experienced birth asphyxia, 12% had neonatal jaundice, and 4.76% developed septicemia. One stillbirth was recorded. These figures are comparable to those reported in a large multicentric study by Singh et al., where early-onset neonatal sepsis and jaundice were the most common complications following PPROM [8].

Furthermore, our study highlights the substantial proportion of neonates (86%) requiring NICU admission, underscoring the need for equipped neonatal care units when managing PPROM conservatively. The high NICU admission rate also reflects the immaturity of many neonates, given that 72% weighed below 2.5 kg, with 24% having very low birth weight (<1.5 kg). This is consistent with data from Bohîlțea et al., who reported NICU admission in 84% of neonates born after expectant management of PPROM, especially those under 34 weeks of gestation [9].

Importantly, the study identified statistically significant correlations between elevated maternal leukocyte count ($p=0.03455$), C-reactive protein levels ($p=0.0009$), and neonatal morbidity. These inflammatory markers are known predictors of intrauterine infection and have been well documented in previous studies as essential components in decision-making algorithms for PPROM management [10,11].

Operative intervention (i.e., cesarean delivery) was also associated with increased neonatal morbidity ($p=0.0020$). While cesarean rates tend to be higher in PPROM due to fetal distress and failed induction, this finding suggests the need for individualized labor management protocols. A similar association was reported by Mahajan et al., who linked emergency cesarean section in PPROM with increased neonatal intensive care admissions [12].

Taken together, these results suggest that expectant management of PPROM, particularly before 34 weeks, remains a viable approach when accompanied by rigorous maternal and fetal surveillance. However, early signs of infection or fetal compromise must prompt reevaluation of conservative strategies in favor of delivery. Our study supports the growing body of evidence advocating for a balanced, evidence-based approach to PPROM, tailored to gestational age and clinical status.

**Limitations**

While this prospective observational study provides valuable insights into the maternal and neonatal outcomes associated with expectant management in PPROM, limitations must be acknowledged. First, the sample size was relatively small (n=21), which may limit the generalizability of the findings. A larger cohort would provide more robust statistical power and allow for stratified analysis across different gestational age groups, infection profiles, and delivery outcomes. Second, although infection markers such as white blood cell count and C-reactive protein were analyzed, serial measurements and more advanced biomarkers (e.g., procalcitonin, interleukin-6) were not incorporated, which may have provided deeper insight into subclinical infections or inflammatory responses. Third, long-term neonatal follow-up beyond the six-week postpartum

period was not conducted. This limits the ability to assess the impact of PPROM and its management on long-term neurodevelopmental outcomes, which are critical in preterm infants.

Lastly, there may have been reporting and observational biases, particularly in assessing clinical signs of chorioamnionitis or in subjective interpretation of fetal distress. Inter-observer variability, though minimized, cannot be entirely ruled out in such clinical studies.
Addressing these limitations in future multicenter, longitudinal studies with larger sample sizes and extended neonatal follow-up will be essential for validating and extending the conclusions drawn from this research.

# CONCLUSION

This study describes the clinical significance of prompt and tailored management in cases of preterm premature rupture of membranes (PPROM), a condition closely linked to substantial maternal and neonatal morbidity. The findings affirm that expectant management in carefully selected, clinically stable patients, especially those with gestational age less than 34 weeks, can lead to favorable perinatal outcomes when implemented with timely interventions including prophylactic antibiotics, antenatal corticosteroids, and vigilant monitoring for infection. The microbial profile in our study, with predominance of gram-negative organisms such as Escherichia coli, and the relatively high rate of urinary tract infections, emphasizes the necessity of routine infection screening and culture-guided antimicrobial therapy. The identification of elevated leukocyte counts and C-reactive protein as significant predictors of neonatal complications highlights the utility of inflammatory biomarkers in guiding the clinical course. Neonatal complications including birth asphyxia, jaundice, and sepsis—though not uncommon—were generally manageable with NICU support, with most neonates demonstrating satisfactory outcomes. However, the high rate of NICU admissions reiterates the importance of delivering such pregnancies in centers equipped with advanced neonatal care facilities. Maternal complications such as febrile illness and wound infections, though observed in a minority, reinforce the need for postnatal surveillance. Overall, this study adds to the growing body of evidence supporting expectant management in early PPROM, with individualized clinical judgment remaining paramount. Multidisciplinary coordination between obstetricians, neonatologists, and infectious disease specialists is critical to achieving optimal maternal and neonatal outcomes. Further large-scale multicenter studies are warranted to refine prognostic markers and standardize management algorithms in PPROM, particularly in resource-limited settings.

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