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Fetomaternal Outcome in Preterm Premature Rupture of Membranes: A Retrospective Study

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ABSTRACT

Background: Preterm Premature Rupture of Membranes (PPROM) is a significant obstetric complication that occurs when the fetal membranes rupture before 37 weeks of gestation, often leading to preterm birth and associated neonatal morbidities. PPROM is linked to an increased risk of maternal infections, neonatal respiratory distress syndrome (RDS), sepsis, and other complications. Despite advancements in perinatal care, managing PPROM remains challenging due to its unpredictable nature and the risks associated with both expectant and active management strategies.

Methods: A retrospective, non-comparative observational study was conducted at Chettinad Hospital and Research Institute over a 24-month period (January 2022 – December 2024). A total of 82 pregnant women diagnosed with PPROM between 24 and 36 weeks of gestation were included. Data were collected from electronic medical records, including maternal demographics, mode of delivery, neonatal birth weight, APGAR scores, NICU admissions, and maternal complications. Statistical analysis was performed using Chi-square and t-tests, with $p<0.05$ considered statistically significant.

Results: The mean maternal age was 28 years (±4 years), and the mean gestational age at PPROM was 32 weeks (±2 weeks). 60% of deliveries were vaginal, while 40% required a C-section, primarily due to fetal distress (50%). 50% of neonates required NICU admission, with RDS (25%) and neonatal sepsis (10%) being the most common complications. Maternal complications were observed in 20% of cases, with chorioamnionitis (15%) being the most frequent.

Conclusion: PPROM significantly increases the risk of preterm birth, neonatal morbidity, and maternal infections. Early diagnosis, timely interventions, and individualized management strategies are essential for optimizing outcomes. Future research should focus on improving risk prediction models and refining management protocols to reduce neonatal and maternal complications associated with PPROM.

1. INTRODUCTION

Pregnancy is a complex physiological process, and any disruption in the normal course of gestation can have significant implications for both the mother and fetus. One such complication that poses a major challenge in obstetric care is Preterm Premature Rupture of Membranes (PPROM). This condition, characterized by the rupture of fetal membranes before 37 weeks of gestation and before the onset of labor, is associated with various maternal and fetal complications, including increased risks of infection, preterm birth, neonatal morbidity, and perinatal mortality (1,2).

PPROM is a leading cause of preterm birth, which remains a significant contributor to neonatal morbidity and mortality worldwide. Despite advances in prenatal care and neonatal medicine, preterm births resulting from PPROM continue to pose challenges due to the limited ability to predict and prevent its occurrence. The condition requires timely diagnosis, appropriate management, and individualized treatment strategies to minimize risks to both the mother and fetus (3). PPROM is defined as the spontaneous rupture of the amniotic sac before 37 weeks of gestation and before the onset of labor. This condition is distinct from premature rupture of membranes (PROM), which occurs at term (≥37 weeks) but before labor begins. PPROM is a subset of preterm birth, and its occurrence significantly increases the likelihood of neonatal complications (4).

PPROM can be diagnosed clinically through the history of sudden leakage of amniotic fluid, confirmed by a sterile speculum examination where fluid pooling is observed in the vaginal canal. Additional diagnostic tools include nitrazine tests, fern ing tests, and ultrasonography to assess amniotic fluid levels (5).

Several risk factors contribute to the occurrence of PPROM, including previous history of preterm birth, infections (chorioamnionitis, bacterial vaginosis, urinary tract infections), multiple gestation, cervical insufficiency, smoking, and poor maternal nutrition (6). While the exact pathophysiology remains unclear, it is believed that inflammation, infections,

mechanical stress, and biochemical factors contribute to membrane weakening, leading to rupture before term (7). The clinical management of PPROM depends on gestational age, fetal viability, and maternal condition. In cases occurring before 34 weeks, expectant management with antibiotics, corticosteroids, and close maternal-fetal monitoring is often preferred to prolong gestation and enhance neonatal outcomes (8). However, if maternal or fetal complications arise, an early delivery may be warranted.

PPROM is a significant cause of preterm birth, which remains one of the leading contributors to neonatal morbidity and mortality worldwide. According to the World Health Organization (WHO), preterm birth complications account for approximately 35% of neonatal deaths globally, highlighting the clinical importance of understanding and managing conditions like PPROM (9). The incidence of PPROM varies widely depending on geographical location, population characteristics, and healthcare access. Studies indicate that PPROM occurs in 2–3% of all pregnancies, but it is responsible for 30–40% of preterm deliveries (10).

This paper aims to explore the fetomaternal outcomes of pregnancies complicated by PPROM, focusing on the prevalence, complications, and associated risks. Understanding the underlying mechanisms, associated risk factors, and effective management strategies is crucial for improving maternal and neonatal outcomes in pregnancies affected by PPROM.

Objective: To predict the fetomaternal outcome of pregnancies complicated by preterm premature rupture of membranes before 37 weeks of gestation.

2. METHODOLOGY

Study Design: This study was conducted as a retrospective, non-comparative observational study to assess the fetomaternal outcomes in pregnancies complicated by Preterm Premature Rupture of Membranes (PPROM). The study was carried out at the Department of Obstetrics and Gynecology, Chettinad Hospital and Research Institute, Kelambakkam, Tamil Nadu, over a period of 24 months, from January 2022 to December 2024. A retrospective observational approach was chosen as it allows for an analysis of previously recorded clinical data, providing insights into the maternal and neonatal outcomes of PPROM without any active intervention.

Sample Size: The total sample size for the study was 82 pregnant women diagnosed with PPROM between 24 and 36 weeks of gestation. The sample was selected based on hospital records of antenatal patients who attended the outpatient department (OPD) and labor room during the study period. The sample size was determined considering the prevalence of PPROM, availability of hospital data, and feasibility of retrospective analysis.

Inclusion and Exclusion Criteria: The study included pregnant women with singleton gestation in longitudinal lie with vertex presentation, diagnosed with PPROM between 24 and 36 weeks of gestation. Women with adequate antenatal records and who delivered at the study hospital were selected to ensure complete follow-up data. Women with multiple gestations, pregnancy-induced hypertension (PIH), antepartum hemorrhage, polyhydramnios, maternal medical disorders (anemia, diabetes mellitus, hypertension, heart disease), and fetal congenital anomalies were excluded from the study. The exclusion criteria were implemented to minimize confounding variables and ensure homogeneity in the study population.

Data Collection Techniques: This study utilized retrospective data collection by reviewing hospital records and patient case files. The following clinical and demographic data were extracted: maternal demographics, gestational age at PPROM, medical and obstetric history, mode of delivery, and maternal complications such as chorioamnionitis, sepsis, and postpartum infections. Neonatal data included gestational age at birth, APGAR scores, neonatal complications (respiratory distress syndrome (RDS), neonatal sepsis, intraventricular hemorrhage (IVH), necrotizing enterocolitis (NEC)), NICU admissions, and perinatal mortality. Data were retrieved from electronic medical records (EMR), discharge summaries, laboratory reports, and neonatal intensive care unit (NICU) records. The data collection process was conducted by trained obstetricians and neonatal specialists to ensure accuracy.

Statistical Analysis: All collected data were entered into Microsoft Excel 2021 and analyzed using IBM SPSS Statistics version 26.0. Categorical variables such as mode of delivery, maternal complications, and neonatal morbidity were expressed as percentages and proportions, while continuous variables such as gestational age at PPROM, birth weight, and APGAR scores were presented as mean ± standard deviation (SD). Comparative analysis was performed using Chi-square tests for categorical variables and Student's t-test for continuous variables to determine the statistical significance of different outcomes. A p-value of <0.05 was considered statistically significant. Descriptive statistics were used to summarize the demographic and clinical characteristics of the study population, while logistic regression models were applied to identify predictors of neonatal morbidity and adverse maternal outcomes.

Ethical Considerations: The study adhered to the ethical principles outlined by the Institutional Ethics Committee (IHEC), Chettinad Hospital and Research Institute. Approval was obtained under protocol ID IHEC-I/3477/25 before the study commenced. Since this was a retrospective study, a waiver of informed consent was granted as patient data were anonymized, and no direct contact with participants was required. To ensure confidentiality, all patient identifiers were removed, and data access was restricted to authorized personnel only.

3. RESULTS

The mean maternal age in the study was 28 years (±4 years, range: 20-38 years). The majority of women (60%) were in the age group of 25-30 years, while 30% were above 30 years and 10% were below 25 years. The mean gestational age at PPROM was 32 weeks (±2 weeks, range: 24-36 weeks). A majority of women (55%) had rupture of membranes between 30-34 weeks, while 30% had rupture between 24-29 weeks, and 15% had rupture beyond 34 weeks.Among the 82 women included in the study: 49 patients (60%) delivered vaginally. 33 patients (40%) underwent a cesarean section (C-section). The most common indication for C-section was fetal distress (50%), followed by non-progress of labor (35%) and maternal sepsis (15%).

Table 1: Maternal Demographics and Pregnancy Characteristics

Parameter	**Percentage (%)**
Mean Maternal Age in years	28 ± 4
Maternal Age Group	
<25 years	10
25-30 years	60
>30 years	30
Mean Gestational age at PPROM in weeks	32 ± 2
Time of Rupture of Membranes	
30-34 weeks	55%
24-29 weeks	30%
> 34 weeks	15%
Mode of Delivery	
Vaginal delivery	60%
C-section	40%
Indication for C-Section	
Fetal distress	50%
Non-progress of labour	35%
Maternal Sepsis	15%

The mean birth weight of neonates was 2.1 kg (±0.5 kg, range: 1.0-3.5 kg). 45% of neonates had low birth weight (<2.0 kg). 55% had a birth weight between 2.0 and 3.5 kg. 10% of neonates were classified as extremely low birth weight (<1.5 kg) and required prolonged NICU care. The mean APGAR score at 5 minutes was 7 (±1.5, range: 4-10). 75% of neonates had an APGAR score ≥7, indicating good adaptation to extrauterine life. 25% had an APGAR score <7, suggesting fetal distress and requiring immediate resuscitation.

Table 2: Neonatal Birth Outcomes

Parameter	**Value**
Mean Birth Weight in kg	2.1 ± 0.5
Low Birth Weight (<2.0 kg)	45%
Normal Birth Weight (2.0 - 3.5 kg)	55%
Extremely Low Birth Weight (<1.5 kg)	10%
Mean APGAR Score at 5 min	7 ± 1.5

APGAR Score ≥7	75%
APGAR Score <7	25%

Among the 82 neonates, 41 (50%) required NICU admission, primarily for the following reasons: Respiratory distress syndrome (RDS) (25%). Neonatal sepsis (10%). Intraventricular hemorrhage (IVH) (5%). Extreme prematurity with complications (10%). Neonatal mortality was observed in 5 cases (6%), primarily due to extreme prematurity and sepsis.

Figure 1: NICU admission

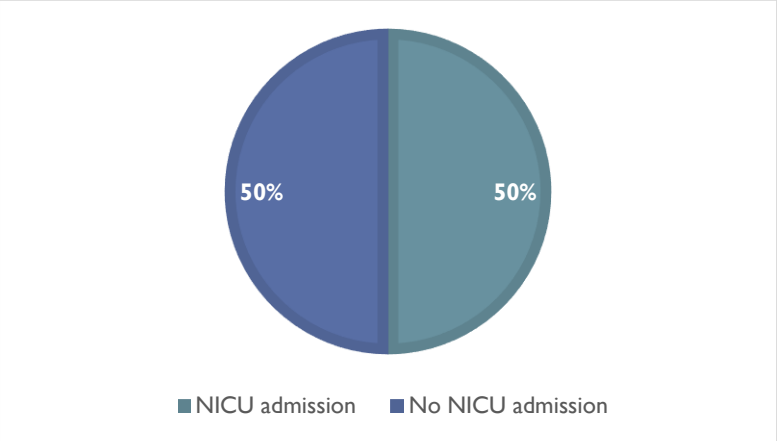
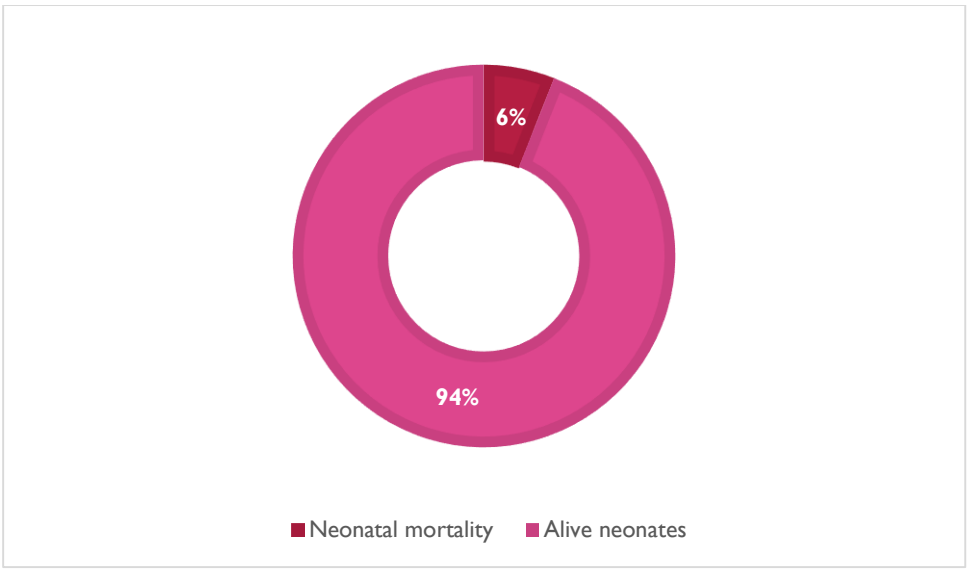


Table 3: NICU Admission and Neonatal Complications

Primary Reasons for NICU Admission	**Value**
- Respiratory Distress Syndrome (RDS)	25% (21 neonates)
- Neonatal Sepsis	10% (8 neonates)
- Intraventricular Hemorrhage (IVH)	5% (4 neonates)
- Extreme Prematurity with Complications	10% (8 neonates)

Figure 2: Neonatal Mortality



Maternal complications were observed in 20% (n=16) of cases, with the most common being: Chorioamnionitis (15%): Diagnosed clinically by maternal fever, uterine tenderness, and fetal tachycardia. Sepsis (5%): Developed in four women, requiring IV antibiotics and prolonged hospital stay. No maternal deaths were recorded in this study.

Table 4: Maternal Complications

Parameter	Total no of cases n=82
Maternal Complications	20% (16 cases)
Types of Maternal Complications:	
- Chorioamnionitis	15% (12 cases)
- Sepsis	5% (4 cases)

Gestational age at PPROM and NICU admission ($p<0.05$) – Neonates born before 30 weeks had a significantly higher NICU admission rate. Low birth weight and neonatal complications ($p=0.02$) – Neonates weighing less than 2 kg had a higher incidence of RDS and sepsis. Chorioamnionitis and preterm labor ($p<0.01$) – Women with chorioamnionitis had a higher rate of preterm labor and fetal distress.

Table 5: Significant Associations in Neonatal and Maternal Outcomes

Association	Chi-Square (χ^2) Value	p-value
Gestational age at PPROM & NICU admission	$\chi^2 = 6.21$	**< 0.05**
Low birth weight (<2 kg) & Neonatal complications	$\chi^2 = 5.85$	**0.02**
Chorioamnionitis & Preterm labor	$\chi^2 = 7.94$	**< 0.01**

4. DISCUSSION

This study provides a comprehensive analysis of maternal and neonatal outcomes in pregnancies complicated by preterm premature rupture of membranes (PPROM). The findings highlight the significant impact of PPROM on both maternal and neonatal health, highlighting the importance of timely diagnosis and appropriate management strategies.

The mean maternal age in this cohort was 28 years (±4 years), with the majority (60%) aged between 25 and 30 years. The mean gestational age at PPROM was 32 weeks (±2 weeks), with 55% of cases occurring between 30 and 34 weeks. These demographics are consistent with existing literature, which identifies similar maternal age distributions and gestational ages at PPROM occurrence [11]. Mode of delivery varied, with 60% of women delivering vaginally and 40% undergoing cesarean sections. The primary indications for cesarean delivery were fetal distress (50%), non-progress of labor (35%), and maternal sepsis (15%). These findings align with previous studies that have reported comparable cesarean rates and indications in PPROM cases [12].

Neonatal outcomes revealed a mean birth weight of 2.1 kg (±0.5 kg), with 45% classified as low birth weight (<2.0 kg) and 10% as extremely low birth weight (<1.5 kg). The mean APGAR score at 5 minutes was 7 (±1.5), with 25% of neonates scoring below 7. Notably, 50% of neonates required NICU admission, primarily due to respiratory distress syndrome (25%), neonatal sepsis (10%), intraventricular hemorrhage (5%), and extreme prematurity with complications (10%). Neonatal mortality was observed in 6% of cases. These outcomes are consistent with the known risks associated with PPROM, particularly the increased likelihood of preterm birth and its associated complications [11]. Maternal complications were observed in 20% of cases, with chorioamnionitis (15%) and sepsis (5%) being the most common. This aligns with existing literature that identifies infection as a significant risk following PPROM [13]. The findings of this study are in concordance with previous research on PPROM. A systematic review by Waters and Mercer highlighted similar maternal and neonatal complications associated with PPROM near the limit of viability, emphasizing the challenges in management and the importance of individualized care plans [11]. Additionally, a meta-analysis by Lin et al. identified several risk factors for premature rupture of membranes, including maternal age and infection, which are consistent with the demographics and complications observed in this study [13].

The findings of this study align with existing literature on PPROM, particularly concerning maternal and neonatal outcomes. For instance, a study by Sim et al. reported that pre-viable PPROM is associated with significant neonatal morbidities, including respiratory distress syndrome and bronchopulmonary dysplasia [12]. Furthermore, individualized management of PPROM has been shown to prolong pregnancy and reduce preterm birth before 32 weeks, as well as decrease the need for neonatal intensive care unit admission and respiratory support at 28 days of life.

The results of this study emphasize the critical need for early detection and management of PPROM to mitigate adverse outcomes. The high incidence of neonatal complications, particularly respiratory distress syndrome and sepsis, highlights the importance of administering antenatal corticosteroids to enhance fetal lung maturity and considering antibiotic

prophylaxis to reduce the risk of neonatal infection [7]. The significant rate of maternal infections, such as chorioamnionitis, suggests that close monitoring and timely intervention are essential to prevent severe maternal morbidity. The mode of delivery should be carefully considered, with a preference for vaginal delivery when feasible. However, the indications for cesarean delivery observed in this study, including fetal distress and non-progress of labor, necessitate readiness for surgical intervention when clinically indicated.

This study contributes to the growing body of evidence on the outcomes of pregnancies complicated by PPROM. The findings highlight the substantial risks to both maternal and neonatal health, emphasizing the need for vigilant monitoring, timely interventions, and individualized management strategies to optimize outcomes. Further research is warranted to explore long-term outcomes and to develop strategies to prevent PPROM and its associated complications.

5. CONCLUSION

This study highlights the significant impact of Preterm Premature Rupture of Membranes (PPROM) on maternal and neonatal outcomes, emphasizing the need for early diagnosis and effective management strategies. The findings revealed that gestational age at rupture, mode of delivery, neonatal birth weight, and maternal complications are key determinants of pregnancy outcomes. From a clinical perspective, the study shows the importance of early detection, infection control, and optimized neonatal care. Antenatal corticosteroids should be administered in cases of PPROM before 34 weeks to enhance fetal lung maturity, while antibiotic prophylaxis should be used to reduce the risk of infections. Expectant management may be considered in stable cases before 34 weeks, with close fetal and maternal surveillance, while prompt delivery is warranted in cases of fetal distress or maternal infection. Neonatal outcomes could be improved by ensuring early sepsis screening, respiratory support, and NICU monitoring, with long-term follow-up for premature infants to assess neurodevelopmental progress. Additionally, postpartum care for mothers should focus on infection screening, mental health support, and reproductive health counseling. Future research should explore long-term neonatal neurodevelopmental and respiratory outcomes in infants born after PPROM, as well as maternal reproductive health and psychological well-being. Developing predictive models that integrate clinical, biochemical, and genetic markers could enhance early risk assessment and targeted interventions. Further research is needed to optimize latency period management, antibiotic regimens, and microbiome-targeted therapies to prevent premature membrane rupture. Additionally, AI-driven predictive models could revolutionize PPROM diagnosis and individualized patient care. In conclusion, PPROM remains a major obstetric challenge, requiring multidisciplinary management strategies to mitigate risks to both mother and baby. By implementing evidence-based protocols, improving prenatal screening, and advancing research on prediction and prevention, maternal and neonatal outcomes can be significantly improved. Future studies should focus on enhancing risk prediction, optimizing management strategies, and improving neonatal survival and long-term health.

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