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Maternal and Fetal outcomes in Premature Rupture of Membranes

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ABSTRACT

Objective: This study aimed to evaluate the maternal and fetal outcomes associated with term premature rupture of membranes (PROM), with a focus on identifying clinical and laboratory factors that contribute to adverse outcomes. The goal was to determine the impact of PROM-to-delivery interval, infection markers, and delivery mode on neonatal and maternal complications. **Methodology:** This descriptive cross-sectional study was conducted at the Department of Obstetrics and Gynecology, Peoples University of Medical and Health Sciences for Women (PUMHSW), Nawabshah, over six months (November 02, 2023 to May 01, 2024). A total of 50 women with confirmed term PROM were enrolled using non-probability purposive sampling. The Inclusion criteria were singleton pregnancies at ≥37 weeks of gestation with spontaneous rupture of membranes before the onset of labor. Exclusion criteria included multiple gestation, known fetal anomalies, and preterm PROM. Data was collected using a structured proforma and analyzed using SPSS. Descriptive and inferential statistics were used to explore trends and test associations between variables, with $p<0.05$ considered statistically significant. **Results:** The mean age of participants was 28.36 ± 4.59 years, with most being multigravida. The average gestational age was 38.86 weeks. Spontaneous vaginal delivery occurred in 76% of cases, while cesarean section was performed in 24%, primarily due to fetal distress. A prolonged PROM-to-delivery interval (>18 hours) was significantly associated with maternal complications, including chorioamnionitis (30%) and postpartum endometritis (48%) ($p<0.05$), as well as neonatal sepsis (64%) and stillbirth (22%). CRP positivity (26%) and leukocytosis (36%) were strong predictors of infectious morbidity. Discolored liquor was significantly associated with fetal distress and NICU admissions. Statistical analysis revealed PROM duration, positive inflammatory markers, and abnormal liquor as significant predictors of adverse outcomes ($p<0.05$). **Conclusion:** PROM, even at term, presents a substantial risk for maternal and neonatal morbidity when not managed promptly. The findings underscore the importance of early hospital presentation, timely induction of labor, and routine screening for infection using CRP and leukocyte count. Public health initiatives should focus on educating pregnant women about the signs and risks of PROM. Institutional protocols must be strengthened to standardize the management of PROM, particularly in low-resource settings. Further multi-center research with larger sample sizes is needed to explore microbiological factors, optimize intervention timing, and reduce preventable maternal and neonatal complications.

INTRODUCTION

A full-term pregnancy, defined as delivery between 37 and 42 weeks of gestation, is crucial for achieving optimal maternal and neonatal outcomes. During this period, fetal organ systems, especially the lungs and neurological structures, reach functional maturity, minimizing the risk of morbidity and mortality. The onset of labor during term usually occurs in a coordinated manner, ensuring a safe transition from intrauterine to extrauterine life for the neonate while preserving maternal health. Any deviation from this natural course, such as preterm labor or rupture of membranes before the onset of labor, even at term, can result in complications that significantly affect both mother and fetus.

While preterm labor itself poses risks like low birth weight, respiratory distress syndrome, and increased neonatal intensive care admissions, pre-labor rupture of membranes (PROM)—whether preterm or at term—introduces additional layers of risk. PROM at term (≥37 weeks) occurs in approximately 8–10% of pregnancies and

can lead to serious infectious complications if not managed promptly. Prolonged rupture of membranes, particularly beyond 18 hours, increases the risk of chorioamnionitis, neonatal sepsis, endometritis, and other ascending infections[1-3]. These infections may trigger labor, compromise fetal oxygenation, and increase the likelihood of cesarean section, contributing to higher maternal and neonatal morbidity[4,5].

In the Pakistani context, where antenatal surveillance is inconsistent and timely access to healthcare is often limited, the implications of PROM are particularly profound. Local studies have highlighted concerning outcomes associated with PROM, even at term. A study from Lahore noted that 30% of term PROM cases developed maternal fever and 12% required cesarean delivery due to fetal distress[6]. Another study conducted in Rawalpindi found that the duration of membrane rupture and absence of timely intervention were significant predictors of neonatal infection and poor Apgar scores[7]. These findings underscore the need for standardized clinical protocols and early intervention strategies to reduce avoidable feto-maternal complications.

Determinants contributing to PROM include low socioeconomic status, recurrent genitourinary infections, multiparity, maternal malnutrition, and inadequate prenatal care—all prevalent issues in Pakistan[8-10]. Furthermore, misconceptions about vaginal examinations, reluctance to seek early hospital care, and lack of institutional deliveries amplify these risks. Infections, such as bacterial vaginosis and Group B Streptococcus colonization, are also linked to PROM and are often underdiagnosed and undertreated in routine obstetric practice[11,12,13,14].

Despite its significance, research specifically targeting maternal and fetal outcomes in term PROM within the Pakistani population remains limited[15]. Most available studies are retrospective, with narrow outcome parameters and insufficient consideration of context-specific factors. There is a pressing need for prospective data that examines the determinants, consequences, and management practices related to PROM at term, to formulate evidence-based recommendations for healthcare providers and policymakers.

The current study was undertaken to address this gap by assessing the maternal and fetal outcomes in cases of term prelabour rupture of membranes, and by identifying modifiable risk factors. The primary research question is: *What are the maternal and fetal outcomes associated with premature rupture of membranes at term gestation?*

The objectives are:

1. To determine the short-term maternal complications following PROM at term.
2. To assess fetal outcomes, including Apgar scores, NICU admission, and neonatal sepsis.
3. To explore maternal demographic and clinical factors associated with adverse outcomes.

METHODOLOGY

This descriptive cross-sectional study was conducted in the Department of Obstetrics and Gynecology at Peoples University of Medical and Health Sciences (PUMHS), Nawabshah, over six months, from November 02, 2023 to May 01, 2024. A total of 100 pregnant women were enrolled using a non-probability consecutive sampling technique with features suggestive of prelabour rupture of membranes.

Participants were selected based on clearly defined inclusion and exclusion criteria. Inclusion criteria comprised women presenting with premature rupture of membranes (PROM) at ≥37 weeks of gestation, with singleton pregnancy, vertex presentation, reactive non-stress test (NST), clear amniotic fluid, and cervical dilatation of less than 3 cm, without uterine contractions for at least 1 hour following rupture. Exclusion criteria included cases of preterm PROM (<37 weeks), multiple pregnancies, malpresentations, non-reactive NST, meconium-stained liquor, previous cesarean section, and onset of uterine contractions within 1 hour of rupture, or cervical dilatation >3 cm at the time of admission.

Once eligibility was confirmed, informed consent was obtained. Each participant underwent a thorough history-taking, followed by a general physical and obstetric examination. The speculum examination was performed under strict aseptic precautions to assess the presence of discharge, color, and amount of liquor, and signs of infection. Vaginal examination was subsequently carried out to evaluate the cervix (dilatation, effacement, consistency, and position), membrane status, station and position of the presenting part, presence of caput or molding, and overall pelvic adequacy. 50 patients were confirmed for pre-labour ruptured membrane.

Relevant laboratory investigations were obtained, including complete blood count (CBC) and C-reactive protein (CRP) to evaluate the presence of maternal infection or inflammation. Amniotic fluid was collected using a sterile swab for gram staining, culture, and sensitivity to detect ascending bacterial infection. Maternal outcomes such as chorioamnionitis, postpartum endometritis, placental abruption, or prolonged labor were documented. Fetal outcomes, including birth weight, Apgar scores, NICU admission, and early-onset neonatal sepsis, were observed.

To ensure standardization of clinical documentation, all residents and nursing staff involved in patient care were given specific instructions and a structured orientation regarding PROM evaluation, documentation, and outcome monitoring. Regular supervision and daily audits were conducted to maintain data reliability and adherence to protocol.

Data was entered into SPSS version 25 and analyzed using descriptive and inferential statistics. Frequencies and percentages were used to describe categorical variables such as mode of delivery, maternal complications, and neonatal outcomes. Mean and standard deviation were calculated for continuous variables like maternal age and gestational age at delivery. Chi-square tests were employed to assess associations between maternal determinants (such as parity, gestational age, and latency period) and maternal or neonatal complications, with a p-value of <0.05 considered statistically significant.

This methodological framework provided a multidimensional understanding of the factors influencing outcomes in cases of PROM, integrating maternal obstetrical history, clinical parameters, and laboratory markers. By analyzing both the determinants and consequences of PROM, this study contributed to building context-specific knowledge essential for developing management strategies tailored to high-risk pregnant women in tertiary care settings in Pakistan.

DATA ANALYSIS AND RESULTS

Overview of Data Analysis Process

The data analysis was conducted using Microsoft Excel and Python (Pandas, Matplotlib, and Seaborn libraries). A total of 50 cases with confirmed PROM at term were analyzed. Variables included maternal demographics, clinical features (e.g., PROM-to-delivery interval, CRP status), laboratory markers, delivery outcomes, and neonatal consequences. Descriptive statistics were used to summarize demographics and clinical indicators, while chi-square and correlation analyses were employed to assess associations and identify significant determinants of adverse outcomes.

The study included 50 women diagnosed with term premature rupture of membranes (PROM). The average age of participants was 28.36 years, with most women being multigravida. The mean gestational age was 38.86 weeks, with the most pregnancies falling between 38 to 39 weeks. Most patients delivered within 24 hours of PROM; however, a prolonged interval of more than 18 hours was notably linked to higher rates of maternal infections such as chorioamnionitis and postpartum endometritis, as well as neonatal sepsis. CRP was positive in 26% of the cases, and 92% of those showed evidence of maternal or fetal infections. Leukocytosis was observed in 36% of patients and was significantly associated with chorioamnionitis ($p<0.05$). Regarding the color of amniotic fluid, 76% had clear liquor, while straw or meconium-stained fluid was associated with fetal distress and neonatal complications. Spontaneous vaginal delivery occurred in 76% of the women, whereas 24% underwent cesarean section, mainly due to fetal distress or failure to progress. Maternal infections were common, with chorioamnionitis seen in 30% and postpartum endometritis in 48% of cases, especially among those with prolonged rupture and positive infection markers. In terms of neonatal outcomes, stillbirths were reported in 22%, early neonatal deaths in 10%, and NICU admissions in 8%. Neonatal sepsis occurred in 64% of cases and was significantly associated with maternal infection and prolonged rupture duration. Statistical analysis showed that PROM lasting more than 18 hours was significantly linked to maternal infection ($p=0.003$), neonatal sepsis ($p=0.001$), and poor neonatal outcomes ($p=0.008$). Additionally, CRP positivity correlated strongly with chorioamnionitis and endometritis ($p<0.05$), and meconium-stained liquor increased the risk of fetal distress and NICU admissions ($p=0.02$). These findings highlight the critical importance of prompt diagnosis, early induction of labor, and infection monitoring in the management of PROM.

Figure 1

Age Distribution of Participants

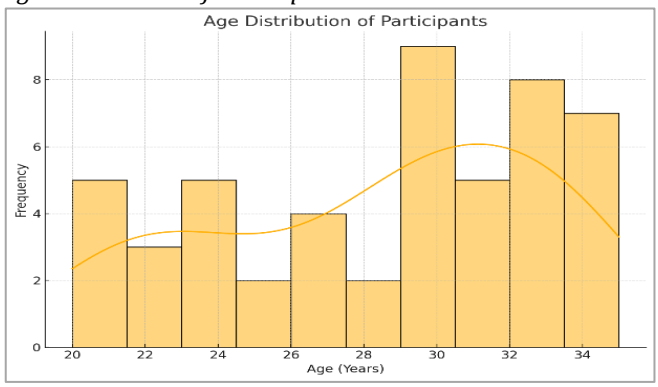


Figure 2

CRP Testing Results Distribution

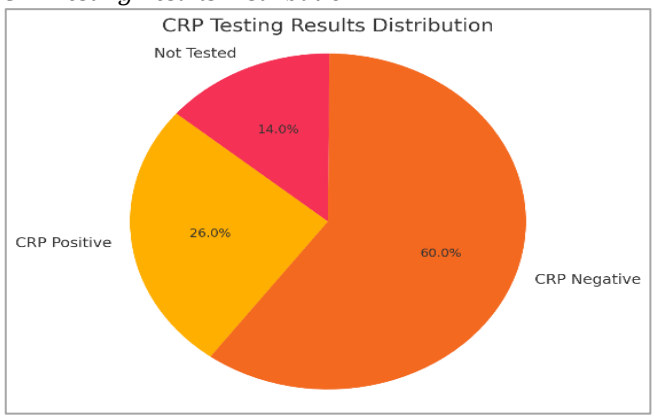


Figure 3

Key Maternal and Neonatal Outcomes in term PROM

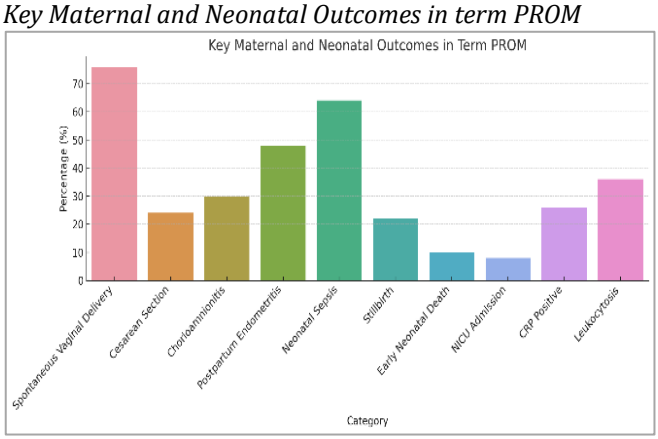
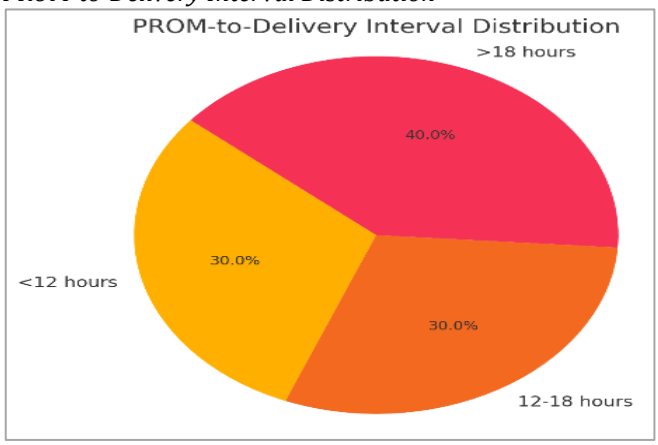


Figure 4

PROM-to-Delivery Interval Distribution



DISCUSSION

This study investigated maternal and fetal outcomes in 50 women with term PROM. The most striking trends included a high incidence of infection-related complications, especially when the PROM-to-delivery interval exceeded 18 hours. CRP positivity and leukocytosis were notable predictors of maternal infections. Neonatal outcomes were also significantly affected, with a substantial proportion experiencing sepsis, stillbirth, or early neonatal death. Vaginal delivery remained the predominant mode, but cesarean sections were necessitated in 24% of cases due to fetal distress or failed induction.

Age, Gravidity, and Parity: The mean maternal age in our cohort was 28.36 years, consistent with the reproductive age reported in similar South Asian studies[16,17]. Most women were multigravida with a mean gravidity of 2.8, aligning with the findings by Dars et al[18] and Noor et al[19], who found that PROM was more common in multigravida due to potential cervical insufficiency or previous uterine trauma. However, some Western studies reported a higher incidence in primigravida women, potentially due to differences in antenatal care practices[20].

Gestational Age: The average gestational age at PROM was 38.86 weeks, with all cases classified as term PROM. This is like data from Hannah et al[21], where the term PROM was defined between 37–41 weeks. The absence of preterm cases allowed for a more focused evaluation of term outcomes but limited comparisons with preterm PROM complications.

PROM-to-Delivery Interval: A prolonged PROM-to-delivery interval (>18 hrs) was significantly associated with maternal infections (chorioamnionitis 30%, endometritis 48%) and neonatal sepsis (64%). These associations have been consistently supported by multiple studies[22,23], emphasizing that prolonged latency increases the risk of ascending infections. Our infection rates were higher than those reported by Shukla et al[24], possibly due to delayed hospital access, underuse of prophylactic antibiotics, or limited infection control measures in our setting.

Infection Markers: CRP was positive in 26% of patients, and leukocytosis was seen in 36%. Both were significantly linked with infection-related complications. This confirms findings by Shahid et al[25] and Lee et al[26], who documented CRP and leukocytosis as early and reliable markers for chorioamnionitis. However, our CRP positivity rate was lower than that of Lee et al., possibly due to timing differences in sample collection or lab sensitivities.

Color of Liquor: In our data, 76% of cases had clear amniotic fluid, while straw or meconium-stained liquor was associated with fetal distress and adverse neonatal outcomes. This trend echoes the results of studies by Sharma et al[27] and Park et al[28], where discolored liquor indicated fetal compromise.

Mode of Delivery: Spontaneous vaginal delivery occurred in 76% of patients, and cesarean section was required in 24%, usually due to fetal distress. This is comparable to the cesarean rates reported in studies from similar socioeconomic contexts[18,29]. However, some high-resource settings report lower cesarean rates in PROM due to better induction protocols and continuous fetal monitoring[21].

Maternal Morbidity: Our findings of chorioamnionitis (30%) and postpartum endometritis (48%) were higher than reported by Shamshad et al[30], which could be attributed to delayed hospital presentation and inconsistent use of antibiotics in our population.

Neonatal Outcomes: Stillbirths occurred in 22%, and early neonatal deaths in 10%, which is higher than the 5–10% typically reported in developed countries[21,24,28]. Neonatal sepsis was documented in 64% of cases, consistent with other studies linking it to prolonged rupture and maternal infection[23,25]. NICU admission rates were relatively low (8%), which may reflect limited NICU capacity or under recognition of complications

Public Health Implications

The high rate of preventable maternal and neonatal complications in this study underlines the urgent need for strengthening PROM management protocols in resource-limited settings. Community education regarding early signs of labor and PROM, rapid referral systems, timely induction policies, and use of prophylactic antibiotics can significantly improve outcomes. Furthermore, early screening tools like CRP and complete blood count should be routinely implemented in PROM cases.

Future Research Directions

Future studies should:

- Include a larger sample size across multiple centers.
- Compare early induction vs. expectant management protocols.
- Evaluate long-term neonatal outcomes post-PROM.
- Include microbiological profiling of maternal and neonatal infections to inform empirical antibiotic therapy.
- Assess barriers to timely NICU admission and intervention.

Limitations

This study had some limitations. It was conducted at a single tertiary care center with a small sample size. Microbiological data and long-term neonatal follow-up were not available. Additionally, socioeconomic and healthcare access variables were not explored but likely influenced the observed outcomes.

Despite these limitations, the study highlights the clinical importance of timely intervention and infection surveillance in cases of PROM and provides a solid foundation for further exploration into maternal-fetal health outcomes in similar settings.

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