Original Article

Spontaneous Preterm Premature Rupture of Membranes and Related Consequences: A Case Series Analysis of Pregnant Women

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ABSTRACT

Background: Preterm premature rupture of membranes (pPROM) poses a significant challenge in obstetrics, associated with considerable perinatal morbidity and mortality. Despite advancements in healthcare, the management and outcomes of pPROM remain areas of concern, necessitating further investigation into effective strategies for prevention and treatment.

Objective: This study aims to investigate the maternal and neonatal outcomes associated with pPROM to develop targeted interventions that can mitigate the associated morbidity and mortality.

Methods: Conducted at GU-IV LUMHS, Jamshoro, over a six-month period from March to September 2018, this case series involved 116 pregnant women aged 20 to 30 years diagnosed with pPROM. Using non-probability consecutive sampling, participants were selected based on specific inclusion and exclusion criteria. Data were collected on demographic characteristics, clinical findings, and outcomes post-pPROM using a pre-designed proforma, following ethical standards aligned with the Declaration of Helsinki. The study employed SPSS version 25 for statistical analysis, calculating means, standard deviations, and employing chi-square tests for categorical variables, with a significance level set at $p<0.05$.

Results: The mean age of participants was 24.96 ± 2.63 years. Maternal complications included chorioamnionitis (11.21%), while neonatal outcomes revealed preterm births (42.24%), stillbirths (10.34%), and early neonatal deaths (12.93%). The comparison with previous studies highlighted a consistent age range vulnerability and underscored the critical outcomes of pPROM, such as high rates of preterm births and associated neonatal complications.

Conclusion: The study emphasizes the persistent challenges posed by pPROM in obstetric care, highlighting the need for enhanced diagnostic and management protocols. Improved understanding and interventions are crucial for reducing the adverse outcomes associated with pPROM, enhancing maternal and neonatal health.

Keywords: Preterm Premature Rupture of Membranes (pPROM), Perinatal Morbidity, Perinatal Mortality, Obstetric Care, Neonatal Outcomes, Maternal Health, SPSS Analysis, Case Series.

INTRODUCTION

Preterm premature rupture of membranes (PPROM) is a critical condition defined by the spontaneous rupture of the amniotic membranes and the release of amniotic fluid between 28 and 37 weeks of gestation. The integrity, development, and functionality of fetal membranes are pivotal for the normal progression and outcome of pregnancy, as they maintain a protective intrauterine environment crucial for fetal survival until labor commences (1). Occurring in 5-10% of pregnancies (2)(3), PPROM is associated with various risk factors including racial background, socioeconomic status, smoking, a history of sexually transmitted infections, previous preterm deliveries, antepartum hemorrhage, polyhydramnios, multiple gestations, and intra-amniotic infection (4)(5). The condition

is linked with significant maternal and neonatal morbidity, including a 7% incidence of maternal chorioamnionitis, a 50% rate of preterm birth, 30% stillbirth, and 18% early neonatal death (9).

The multifactorial etiology of PPROM frequently involves subclinical chorioamnionitis, playing a major role in its pathogenesis and the ensuing maternal and neonatal complications (3)(6). Therefore, the evaluation and management of PPROM are critical for enhancing neonatal outcomes. Accurate diagnosis relies on a comprehensive history, physical examination, and supporting laboratory studies, enabling gestational age-specific obstetric interventions to improve perinatal outcomes and minimize fetomaternal complications. In cases of PPROM, digital vaginal examinations are linked with shorter latency periods and potential adverse outcomes (4). Confirmatory diagnosis of PPROM is established through sterile speculum examination, evidenced by cervical dilation and amniotic fluid leakage, alongside a reduced amniotic fluid index (AFI) on ultrasound (6).

The amniotic fluid volume serves as an essential indicator of fetal well-being. The AFI ultrasound technique, categorizing oligohydramnios when AFI is less than 5 cm and severe oligohydramnios when below 3 cm, is utilized for assessment (7). Management strategies for PPROM include the administration of antibiotics to lower the risk of perinatal infection and prolong latency periods, while corticosteroids are employed to decrease perinatal morbidity and mortality (8).

This study aimed to assess the current local magnitude of fetomaternal outcomes associated with PPROM to develop strategies that could further reduce the related morbidity and mortality. Understanding the complex interplay of risk factors, etiology, and effective management approaches for PPROM is essential for healthcare providers to optimize care for this high-risk population, ultimately improving both maternal and neonatal health outcomes.

MATERIAL AND METHODS

The study was conceived as a case series, carried out at the GU-IV LUMHS, Jamshoro, over a span of six months from March 7, 2018, to September 7, 2018. Its primary aim was to meticulously investigate the incidence of various critical outcomes, namely maternal chorioamnionitis, preterm birth, stillbirth, and early neonatal death, among a specific demographic. To achieve a statistically significant analysis, a sample size of 116 participants was determined as necessary. Selection criteria were rigorously defined to ensure a focused and valid examination of the preterm premature rupture of membranes (PPROM) within the age range of 20 to 30 years, adhering to a stringent operational definition formulated for this investigation.

Participants were identified through a non-probability consecutive sampling method, prioritizing a precise subset of the population while applying exclusion criteria to maintain the study's specificity and validity. Excluded were those pregnant with multiples, exhibiting signs of leaking for an extended period, or having uterine contractions with cervical dilatation exceeding 3 cm, aiming to refine the study focus and enhance reliability. Following the acquisition of approval from the CPSP & ERC of the institution, data collection commenced. Eligible women presenting with symptoms indicative of PPROM and satisfying the inclusion criteria were registered after giving informed written consent, employing a meticulously designed proforma for data acquisition.

The collected data encompassed a broad spectrum of variables including demographic details, clinical examination findings, and outcomes of management strategies, emphasizing both maternal and neonatal repercussions. The approach to treatment, be it conservative or leading to pregnancy termination, was guided by the departmental protocol and tailored to the specific needs of the mother and fetus. Special attention was given to the ethical considerations of the study, adhering to the Declaration of Helsinki to ensure the rights, safety, and well-being of the participants were paramount.

For the analysis, the study leveraged SPSS version 25, marking an update from the initially mentioned version to enhance the robustness of the statistical examination. The analysis involved calculating means and standard deviations for continuous variables such as age, parity, and gestational age. Categorical variables were assessed through frequency and percentage distributions, focusing on aspects like family income, residence, mode of delivery, and fetomaternal outcomes. The study further employed stratification to mitigate the effects of potential modifiers including age, parity, gestational age, family monthly income, and mode of delivery on the outcome variables.

RESULTS

In this study, a detailed analysis of patient characteristics and fetomaternal outcomes was conducted, yielding insightful results encapsulated in several tables. The descriptive statistics of the patients, as presented in Table 1, revealed an average age of 24.96 years with a standard deviation of 2.63 years, and a 95% confidence interval for the mean age ranging from 24.47 to 25.44 years. The mean parity was found to be 1.65, with a standard deviation of 0.74 and a 95% confidence interval extending from 1.51 to 1.78. Additionally, the gestational age averaged at 36.55 weeks, with a standard deviation of 2.31 weeks and a confidence interval for the mean gestational age stretching from 36.13 to 36.98 weeks.

Table 1: Descriptive Statistics of Patients

Variables	Mean	Std. Deviation	95% Confidence Interval for Mean
Age (Years)	24.96	2.63	24.47- 25.44
Parity	1.65	0.74	1.51- 1.78
Gestational age (weeks)	36.55	2.31	36.13- 36.98

Table 2: Comparison of Fetomaternal Outcome Between Age Groups

Fetomaternal Outcome	Age Groups (Years)		P-Value
	≤ 25 Years n=69	> 25 Years n=47	
Chorioamnionitis	6 (8.7%)	7 (14.9%)	
Pre-Term	31 (44.9%)	18 (38.3%)	
Still Birth	8 (11.6%)	4 (8.5%)	
Early Neonatal Death	10 (14.5%)	5 (10.6%)	

Table 3: Comparison of Fetomaternal Outcome Between Gestational Age

Fetomaternal Outcome	Gestational Age		P-Value
	≤ 36 Weeks n=49	37-40 Weeks n=67	
Chorioamnionitis	5 (10.2%)	8 (11.9%)	
Pre-Term	49 (100%)	0 (0%)	
Still Birth	8 (16.3%)	4 (6%)	
Early Neonatal Death	12 (24.5%)	3 (4.5%)	

Table 4: Comparison of Fetomaternal Outcome Between Parity

Fetomaternal Outcome	Parity		P-Value
	Primi n=71	Multi n=45	
Chorioamnionitis	9 (12.7%)	4 (8.9%)	
Pre-Term	31 (43.7%)	18 (40%)	
Still Birth	8 (11.3%)	4 (8.9%)	
Early Neonatal Death	7 (9.9%)	8 (17.8%)	

Further investigation into the fetomaternal outcomes based on age groups, delineated in Table 2, highlighted a comparison between younger (≤25 years) and older (>25 years) pregnant women. Among the younger cohort, 8.7% experienced chorioamnionitis, compared to 14.9% in the older group. Preterm births were observed in 44.9% of the younger group versus 38.3% in the older group. The rates of stillbirth and early neonatal death were also evaluated, with the younger group showing rates of 11.6% and 14.5%, respectively, compared to 8.5% and 10.6% in the older group.

Table 3 offered a comparison of outcomes across different gestational ages, particularly distinguishing between ≤36 weeks and 37-40 weeks of gestation. Remarkably, all women (100%) with a gestational age of ≤36 weeks experienced pre-term births, in stark contrast to none (0%) in the 37-40 weeks category. Chorioamnionitis rates were somewhat similar between the two groups, at 10.2% for ≤36 weeks and 11.9% for 37-40 weeks. Additionally, the incidence of stillbirths and early neonatal deaths was notably higher in the group with gestational ages of ≤36 weeks, at 16.3% and 24.5% respectively, compared to 6% and 4.5% for those between 37 and 40 weeks of gestation.

The analysis of fetomaternal outcomes based on parity, as detailed in Table 4, differentiated between primiparous (Primi) and multiparous (Multi) women. The occurrence of chorioamnionitis was 12.7% among primiparous women, slightly higher than the 8.9% observed among multiparous. Pre-term birth rates were comparable, with 43.7% for primiparous and 40% for multiparous women. The study also noted stillbirths and early neonatal death rates, with primiparous women experiencing rates of 11.3% and 9.9%, respectively, while multiparous women showed slightly lower and higher rates, respectively, at 8.9% and 17.8%.

These findings underscore the multifaceted nature of fetomaternal outcomes influenced by various factors including age, gestational age, and parity. Each table (Tables 1-4) contributes crucial data towards understanding the implications of these factors on maternal and neonatal health, paving the way for targeted interventions to mitigate risks associated with preterm premature rupture of membranes.

DISCUSSION

The phenomenon of premature rupture of membranes (PROM), characterized by the rupture of the amniotic sac before labor onset at or beyond 37 weeks of gestation, remains a significant obstetric challenge. When this condition extends beyond 24 hours before the onset of labor, it is classified as prolonged rupture of membranes (10). The detection of pathogenic microorganisms in the human vaginal flora shortly after membrane rupture underscores the potential role of bacterial infection in the pathogenesis of preterm premature rupture of membranes (pPROM). The intricate process leading to PROM, particularly its association with the mechanical properties of the amniotic sac membranes, has yet to be fully elucidated. Notably, the comparison of cytokine levels in umbilical cord blood to maternal levels reveals a substantial fetal/placental contribution, although these cytokine levels have not proven sufficiently predictive for clinical application.

In the current study, the mean age of participants was observed to be 24.96 ± 2.63 years, aligning with findings from previous research. Akter et al. and Triniti et al. documented mean ages of 27.24 ± 6.28 years and 29.8 ± 7.2 years, respectively, among patients experiencing pPROM, while Mohan et al. reported a mean age of 26.3 ± 6.9 years in a similar cohort, predominantly within the 21-30 year age range, suggesting a common age distribution among those affected by pPROM.

This study identified associations between pPROM and various outcomes, including maternal chorioamnionitis (18.2%), preterm birth (50%), stillbirth (30%), and early neonatal death (18%) (9). In comparison, the present investigation reported chorioamnionitis rates of 11.21%, with preterm births constituting 42.24%, stillbirths at 10.34%, and early neonatal deaths at 12.93%. These findings are somewhat divergent from those of Mohan et al., who reported stillbirths and neonatal deaths at lower rates, resulting in a perinatal mortality rate significantly lower than what was observed in the current study.

PROM's contribution to pregnancy outcomes cannot be overstated, occurring in 5-15% of pregnancies and being a principal factor in preterm births, which significantly impact perinatal morbidity and mortality. Indeed, PROM is a leading cause of premature birth and is associated with 18% to 20% of perinatal deaths in the United States, underlining its critical importance in perinatal health. The condition also entails significant maternal and fetal risks, contributing to 18%-20% of prenatal mortalities and 21.4% of prenatal morbidity, with maternal complications ranging from intra-amniotic infection to placental abruption and postpartum endometritis (120,121).

Despite advancements in perinatal care, pPROM remains a substantial cause of perinatal morbidity and mortality, underscoring the need for enhanced preventive strategies and management protocols. The inclusion of vaginal swab cultures and the targeted use of specific antibiotics represent critical areas for improvement. The findings of this study, while contributing valuable insights into the epidemiology and outcomes of pPROM, must be interpreted within the context of its limitations, including its design and the potential for selection bias. The reliance on specific populations may also limit the generalizability of the results. Future research should aim to expand understanding of pPROM's pathogenesis and refine management strategies to mitigate its impact on maternal and neonatal health. Recommendations for further study include larger, more diverse cohorts and the exploration of innovative diagnostic and treatment modalities to improve outcomes for both mothers and infants affected by this condition.

CONCLUSION

The study on preterm premature rupture of membranes (pPROM) underscores its significant impact on perinatal morbidity and mortality, highlighting a pressing need for enhanced prevention and management strategies in obstetric care. Despite advancements in perinatal healthcare, pPROM continues to present a challenge, with implications for maternal and neonatal health that call for improved diagnostic approaches, the judicious use of antibiotics, and targeted interventions to reduce the incidence and severity of outcomes. Addressing these needs is crucial for advancing maternal and neonatal healthcare outcomes, underscoring the importance of ongoing research and innovation in obstetrics.

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