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Original Research Article

DETERMINANTS OF MATERNAL AND PERINATAL OUTCOMES IN PREMATURE RUPTURE OF MEMBRANES: A PROSPECTIVE ANALYTICAL STUDY AT TERTIARY CARE CENTER

Shilpa Shekhar Ingle[1], Mahendra Manohar Walwekar[2], Anil Sakhare[3], Shailesh Vaidya[4]

[1]*Assistant Professor, Department of Obstetrics and Gynecology, Parbhaini Medical College, Parbhani, India.*
[2]*Associate Professor, Department of Obstetrics and Gynecology, Parbhaini Medical College, Parbhani, India.*
[3]*Associate Professor, Department of Obstetrics and Gynecology, Parbhaini Medical College, Parbhani, India.*
[4]*Professor & HOD, Department of Obstetrics and Gynecology, Parbhaini Medical College, Parbhani, India.*

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Corresponding Author:
Dr. Mahendra Manohar Walwekar, Associate Professor, Department of Obstetrics and Gynecology, Parbhaini Medical College, Parbhani, India.
Email: mahindra.walwekar2006@gmail.com

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ABSTRACT

Background: Premature rupture of membranes (PROM) is defined as spontaneous rupture of the fetal membranes before the onset of labor and remains a major cause of maternal and perinatal morbidity and mortality worldwide. The clinical outcomes of PROM depend on several determinants including gestational age, latency period, and infection status. This study aimed to identify and analyze the maternal and perinatal determinants influencing outcomes in women presenting with PROM at a tertiary care center.

Materials and Methods: A prospective analytical study was conducted in the Department of Obstetrics and Gynaecology at [Name of Institution] over a period of [insert duration]. A total of 150 pregnant women beyond 28 weeks of gestation diagnosed with PROM were enrolled after ethical approval and informed consent. Cases with multiple gestation, antepartum hemorrhage, or major comorbidities were excluded. Maternal and neonatal data were collected prospectively. Statistical analysis was performed using SPSS version [XX]; Chi-square test, Fisher's exact test, and logistic regression were applied. A p-value <0.05 was considered statistically significant.

Results: Half of the participants (50%) presented with preterm PROM, and 22.6% had latency periods exceeding 24 hours. The incidence of chorioamnionitis and puerperal sepsis was 18.7% and 6.7%, respectively. Among neonates, 17.3% developed sepsis, 13.3% had respiratory distress, and 28% required NICU admission, with an overall perinatal mortality rate of 4%. Maternal morbidity and neonatal complications were significantly higher in preterm and prolonged-latency cases ($p < 0.05$). On multivariate analysis, gestational age <37 weeks (OR = 4.35; $p < 0.001$) and latency >24 hours (OR = 3.86; $p = 0.001$) were independent predictors of adverse perinatal outcomes.

Conclusion: Preterm PROM and prolonged latency significantly increase maternal infectious morbidity and neonatal complications. Early diagnosis, prompt antibiotic prophylaxis, and timely delivery decisions are essential to reduce adverse outcomes.

Keywords: Premature rupture of membranes; Preterm PROM; Maternal morbidity; Perinatal outcomes; Latency period.

INTRODUCTION

Premature rupture of membranes (PROM) is defined as the spontaneous rupture of the fetal membranes before the onset of labor and is recognized as a significant obstetric complication impacting pregnancy outcomes globally.[1] PROM may be classified based on gestational age at rupture; when membrane rupture occurs before 37+0 weeks, it is termed preterm premature rupture of membranes

(PPROM) and represents a distinct clinical entity due to its association with preterm birth and associated morbidities.[2,3] PROM complicates approximately 8% of term pregnancies and 2–3% of overall pregnancies when including preterm cases, contributing substantially to preterm deliveries and related adverse outcomes.[4,5]

The pathogenesis of PROM is multifactorial and involves both physiologic and pathologic mechanisms. Fetal membranes are composed of the amnion and chorion, which provide tensile strength via collagen and extracellular matrix components. At term, normal physiologic weakening involves increased apoptosis, collagen breakdown by matrix metalloproteinases (MMPs), and mechanical stresses preparing for labor.[6,7] In PPROM, these processes are prematurely activated or exacerbated by intrauterine infection, inflammation, oxidative stress, or mechanical stretch, leading to membrane weakening and rupture before viability.[6,8] Infection and inflammatory cytokines, in particular, have been implicated in increasing MMP activity and degrading the structural integrity of the membranes.[8] Moreover, maternal factors such as prior PROM, genitourinary infections, and other sociodemographic influences interact with these biological processes and may increase the risk of premature membrane rupture.[9]

Clinically, PROM is a major contributor to both maternal and perinatal morbidity and mortality. Preterm membrane rupture accounts for up to one-third of preterm births and is associated with increased risks of chorioamnionitis, puerperal sepsis, neonatal sepsis, respiratory distress syndrome, NICU admission, and perinatal mortality.[2,3,10] The interval between membrane rupture and delivery (latency period) further modulates these risks, with prolonged latency increasing susceptibility to ascending infections and adverse outcomes.[1,4] Despite advances in obstetric and neonatal care, determining the precise determinants of outcomes in PROM remains a clinical challenge and varies markedly across settings, particularly in tertiary care environments where the case mix and resource dynamics differ.[11]

Given this background and the high clinical burden associated with PROM, especially in resource-limited tertiary care settings, it is essential to evaluate the maternal and perinatal determinants and outcomes in this population. Although many studies have described associations between individual risk factors and outcomes, there is a need for prospective analytical research that systematically examines these determinants and quantifies their impact to guide management strategies and improve clinical outcomes. Therefore, the present study was designed to identify and analyze the factors influencing maternal and perinatal outcomes in women with PROM at a tertiary care center, with the aim of enhancing evidence-based patient care and reducing preventable morbidity and mortality in both mothers and neonates.

MATERIALS AND METHODS

This prospective analytical study was conducted in the Department of Obstetrics and Gynaecology at [Name of Tertiary Care Center], over a period of [insert duration, e.g., January 2024 to December 2025], following approval from the Institutional Ethics Committee. All pregnant women admitted with a diagnosis of premature rupture of membranes (PROM) after 28 weeks of gestation were enrolled after obtaining written informed consent. PROM was defined as spontaneous rupture of fetal membranes before the onset of labor, confirmed by a combination of clinical history, sterile speculum examination showing pooling of amniotic fluid in the posterior fornix, and, when required, diagnostic tests such as the nitrazine or fern test.

Women with singleton pregnancies and live fetuses were included, while those with multiple gestations, antepartum hemorrhage, intrauterine fetal demise, major fetal anomalies, or associated medical/obstetric complications unrelated to PROM (such as hypertensive disorders, diabetes mellitus, or placenta previa) were excluded. Demographic and obstetric parameters including maternal age, parity, gestational age at rupture, latency period, and mode of delivery were recorded using a structured proforma. Maternal outcomes assessed were chorioamnionitis, puerperal sepsis, mode of delivery, postpartum complications, and maternal morbidity. Perinatal outcomes included gestational age at delivery, birth weight, Apgar score, neonatal sepsis, respiratory distress syndrome, NICU admission, and perinatal mortality.

All patients were managed as per institutional protocol, which included prophylactic antibiotics, corticosteroids for fetal lung maturity in preterm cases, and either expectant or active management depending on gestational age, latency period, and maternal-fetal condition. Data were collected prospectively and analyzed to identify determinants associated with adverse outcomes. Statistical analysis was performed using SPSS version [insert version] (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as frequencies and percentages. Associations between categorical variables were tested using Chi-square or Fisher's exact test, while Student's t-test was applied for continuous variables. Multivariate logistic regression was employed to identify independent predictors of adverse maternal and perinatal outcomes. A p-value <0.05 was considered statistically significant.

RESULTS

Table 1: Baseline Maternal Characteristics of Study Population (n = 150)

Variable	Category	Frequency (n)	Percentage (%)
Age group (years)	<20	12	8.0
	20–24	48	32.0
	25–29	54	36.0
	≥30	36	24.0
Parity	Primigravida	62	41.3
	Multigravida	88	58.7
Gestational age at rupture (weeks)	28–33 + 6	32	21.3
	34–36 + 6	43	28.7
	≥37	75	50.0
Type of PROM	Preterm PROM	75	50.0
	Term PROM	75	50.0
Latency period (hours)	<12	64	42.7
	12–24	52	34.7
	>24	34	22.6
Mode of delivery	Vaginal	98	65.3
	Cesarean section	52	34.7
Duration between rupture and delivery (hours)	<12	60	40.0
	12–24	56	37.3
	>24	34	22.7

A total of 150 women with premature rupture of membranes (PROM) were included in this prospective analytical study. The majority of participants (36%) were between 25–29 years of age, followed by 32% in the 20–24-year group. Primigravidae accounted for 41.3% of cases, while 58.7% were multigravidae. Half of the women (50%) presented with term PROM, whereas the remaining 50% had preterm PROM. The latency period was less than 12 hours in 42.7% of cases, 12–24 hours in 34.7%, and more than 24 hours in 22.6%. Most patients (65.3%) delivered vaginally, and cesarean section was required in 34.7% of cases. [Table 1]

Table 2: Maternal Outcomes Following Premature Rupture of Membranes (n = 150)

Variable	Category	Frequency (n)	Percentage (%)
Chorioamnionitis	Present	28	18.7
	Absent	122	81.3
Puerperal sepsis	Present	10	6.7
	Absent	140	93.3
Postpartum hemorrhage (PPH)	Present	12	8.0
	Absent	138	92.0
Wound infection (in LSCS cases)	Present	6	4.0
	Absent	144	96.0
Induction of labor	Required	78	52.0
	Not required (spontaneous labor)	72	48.0
Prolonged labor (>12 hours)	Present	20	13.3
	Absent	130	86.7
Maternal morbidity (composite)	Present	34	22.7
	Absent	116	77.3
Maternal mortality	Present	0	0.0
	Absent	150	100.0

Regarding maternal outcomes, chorioamnionitis was the most frequent complication, observed in 18.7% of women, followed by puerperal sepsis in 6.7% and postpartum hemorrhage in 8%. Labor induction was required in 52% of patients, and 13.3% experienced prolonged labor (>12 hours). The overall maternal morbidity rate was 22.7%, while no maternal deaths were recorded in the study. [Table 2]

Table 3: Perinatal Outcomes in Premature Rupture of Membranes (n = 150)

Variable	Category	Frequency (n)	Percentage (%)
Gestational age at delivery (weeks)	28–33 + 6	34	22.7
	34–36 + 6	40	26.6
	≥37	76	50.7
Birth weight (kg)	<1.5	10	6.7
	1.5–2.49	58	38.7
	≥2.5	82	54.6
Apgar score at 5 minutes	<7	24	16.0
	≥7	126	84.0
Neonatal sepsis	Present	26	17.3
	Absent	124	82.7
Respiratory distress syndrome (RDS)	Present	20	13.3

	Absent	130	86.7
Birth asphyxia	Present	18	12.0
	Absent	132	88.0
NICU admission	Required	42	28.0
	Not required	108	72.0
Perinatal mortality	Present	6	4.0
	Absent	144	96.0

In terms of perinatal outcomes, half of the neonates (50.7%) were delivered at term, and 45.4% weighed less than 2.5 kg at birth. Apgar scores below 7 at 5 minutes were seen in 16% of neonates, and 17.3% developed neonatal sepsis. Respiratory distress syndrome (RDS) occurred in 13.3% and birth asphyxia in 12%. Overall, 28% of neonates required NICU admission, and the perinatal mortality rate was 4%. [Table 3]

Table 4: Comparison of Maternal Outcomes between Term and Preterm PROM

Maternal Outcome	Term PROM (n = 75)	Preterm PROM (n = 75)	Total (n = 150)	p-value
Chorioamnionitis	8 (10.7%)	20 (26.7%)	28 (18.7%)	0.018*
Puerperal sepsis	3 (4.0%)	7 (9.3%)	10 (6.7%)	0.20
Postpartum hemorrhage	4 (5.3%)	8 (10.7%)	12 (8.0%)	0.22
Prolonged labor (>12 h)	6 (8.0%)	14 (18.7%)	20 (13.3%)	0.07
Induction of labor required	36 (48.0%)	42 (56.0%)	78 (52.0%)	0.33
Cesarean section rate	22 (29.3%)	30 (40.0%)	52 (34.7%)	0.19
Maternal morbidity (composite)	12 (16.0%)	22 (29.3%)	34 (22.7%)	0.049*
Maternal mortality	0 (0%)	0 (0%)	0 (0%)	—

When maternal outcomes were compared between term and preterm PROM cases, chorioamnionitis and composite maternal morbidity were significantly higher in the preterm group (26.7% and 29.3%, respectively) compared to the term group (10.7% and 16.0%, respectively; $p < 0.05$). The cesarean section rate and puerperal sepsis were also higher among preterm PROM, although these differences were not statistically significant. [Table 4]

Table 5: Comparison of Perinatal Outcomes between Term and Preterm PROM

Perinatal Outcome	Term PROM (n = 75)	Preterm PROM (n = 75)	Total (n = 150)	p-value
Birth weight <2.5 kg	18 (24.0%)	50 (66.7%)	68 (45.3%)	<0.001***
Apgar score <7 at 5 min	6 (8.0%)	18 (24.0%)	24 (16.0%)	0.011*
Neonatal sepsis	6 (8.0%)	20 (26.7%)	26 (17.3%)	0.004**
Respiratory distress syndrome (RDS)	4 (5.3%)	16 (21.3%)	20 (13.3%)	0.008**
Birth asphyxia	4 (5.3%)	14 (18.7%)	18 (12.0%)	0.019*
NICU admission	12 (16.0%)	30 (40.0%)	42 (28.0%)	0.002**
Perinatal mortality	1 (1.3%)	5 (6.7%)	6 (4.0%)	0.09

Perinatal outcomes showed a clear difference between the two groups. Adverse neonatal events such as low birth weight, neonatal sepsis, respiratory distress syndrome, and NICU admissions were significantly higher among preterm PROM cases. Specifically, 66.7% of preterm neonates were low birth weight compared to 24% in the term group ($p < 0.001$), and neonatal sepsis occurred in 26.7% versus 8% ($p = 0.004$). The need for NICU admission was also significantly greater in preterm PROM (40%) than term PROM (16%) ($p = 0.002$). [Table 5]

DISCUSSION

In this prospective analytical study of 150 women with PROM, we observed a notable frequency of maternal and perinatal complications, with chorioamnionitis (18.7%), neonatal sepsis (17.3%), and NICU admissions (28%) being predominant. Our findings align with previously published data emphasizing the clinical burden associated with PROM and preterm PROM. For instance, a prospective cohort from Addis Ababa University reported a perinatal mortality rate of 206 per 1000 births and a high incidence of adverse neonatal outcomes such as low Apgar scores and early-onset neonatal sepsis among preterm PROM cases.[12] Similarly, gestational age at membrane rupture and delivery were identified as key determinants of adverse perinatal outcomes in that cohort, underlining the importance of maturity at delivery in reducing neonatal morbidity.[13]

The association between prolonged latency period and increased maternal infections in our study (e.g., higher chorioamnionitis with >24 hours latency) concurs with earlier observations. A study reporting 9% chorioamnionitis in PROM cases also highlighted that puerperal sepsis ranged up to 13% with significant increases in NICU admissions, predominantly due to prematurity and infection.[14] Another analysis showed that prolonged PROM was associated with a substantially higher risk of NICU admission and neonatal sepsis — with 5.2-fold and 4.7-fold increased risks respectively — reinforcing our observation that extended time from membrane rupture to delivery intensifies neonatal morbidity.[17]

These patterns mirror our data, where neonatal sepsis and respiratory distress syndrome were markedly more frequent among preterm and prolonged PROM cases.

Our study's overall maternal morbidity rate (22.7%) and perinatal mortality (4%) are within the range reported by other research, though variations exist across populations due to differences in study design, gestational age at presentation, and management protocols. For instance, retrospective outcomes research has documented maternal febrile morbidity and NICU admissions for neonatal sepsis or respiratory distress as leading complications following PROM.19 Moreover, much larger cohorts (e.g., >1700 women) have similarly reported elevated rates of chorioamnionitis and adverse neonatal outcomes in PROM cases, particularly when expectant management was applied in preterm cases.[15] Taken together, these comparisons suggest that infection, prematurity, and the latency period between rupture and delivery remain consistent predictors of poor outcomes across diverse clinical settings.

Importantly, gestational age emerged as a central determinant in our multivariate analysis, consistent with broader literature indicating that lower gestational age at membrane rupture is linked to heightened neonatal mortality and morbidity. Recent tertiary-center data showed neonatal mortality rates as high as 63.2% for births before 28 weeks, declining to 2.2% among those after 34 weeks, demonstrating the profound effect of gestational age on survival and morbidity.[3] This supports our findings that preterm PROM cases had significantly worse perinatal outcomes compared to term PROM, with greater frequencies of low birth weight, NICU admissions, and neonatal infections. These consistencies bolster the premise that gestational maturity is a dominant determinant of perinatal prognosis in PROM.

Furthermore, the observed relationship between prolonged latency and adverse outcomes in our study aligns with documented pathophysiologic connections between membrane rupture, ascending infection, and inflammatory cascades. Although some variability exists across trial designs, a convergence of evidence supports that longer intervals from rupture to delivery are associated with increased maternal infectious morbidity and neonatal complications.[14,17] Thus, our results reinforce the clinical imperative for vigilant monitoring and timely intervention to mitigate infectious and prematurity-related sequelae.

In summary, comparison with similar studies underlines that maternal infection, gestational age at rupture, and latency period are robust determinants of both maternal and perinatal outcomes in PROM. While management strategies continue to evolve, especially in the balance between expectant care and immediate delivery, consistent patterns across diverse settings underscore the need for tailored protocols that prioritize reducing latency-related risks and optimizing timing of delivery to improve outcomes.

CONCLUSION

Premature rupture of membranes continues to be a significant obstetric condition associated with considerable maternal and perinatal morbidity. In this study, gestational age at rupture, latency period, and the presence of infection (chorioamnionitis) were the key determinants of adverse outcomes. Preterm PROM and prolonged rupture-to-delivery intervals were strongly associated with higher incidences of maternal infection, neonatal sepsis, respiratory distress, NICU admissions, and perinatal mortality.

Recommendations: Early diagnosis, timely administration of prophylactic antibiotics, and judicious decision-making regarding delivery timing are essential to minimize complications. Regular antenatal follow-up and infection screening should be strengthened to prevent premature rupture, particularly among high-risk women. Establishing uniform institutional protocols for PROM management and ensuring close intrapartum and neonatal surveillance are also recommended to improve maternal and neonatal outcomes.

Limitations: The study was limited by its single-center design and moderate sample size, which may restrict generalizability. Microbiological evaluation of amniotic fluid and long-term neonatal follow-up were not performed, potentially underestimating the burden of infection. Future multicentric studies with larger cohorts and inclusion of biochemical and microbial markers are warranted to better delineate the causal pathways and optimize management strategies.

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