

Research Article**Clinical Profile and Feto-Maternal Outcomes of Pregnancies Complicated by Premature Rupture of Membranes: A Prospective Observational Study****Dr. Sushma Rachel S, Dr. Vinodini P**

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Abstract**Background**

Premature rupture of membranes (PROM) is a major obstetric complication associated with maternal infection, prolonged latency, preterm birth, neonatal morbidity and adverse perinatal outcomes. Clinical consequences are determined by gestational age at rupture of membranes, duration of rupture of membranes, presence of maternal or fetal complications. This study evaluated the clinical profile and feto-maternal outcomes of pregnancies with PROM.

Objectives

To find out the clinical features, management practices, maternal and neonatal outcomes in women with premature rupture of membranes.

Material and Methods

A prospective observational study was conducted on 200 pregnant women with PROM managed at a tertiary care teaching hospital. Maternal demographic and obstetric characteristics, gestational age at rupture, latency interval, mode of delivery, maternal complications, neonatal

birth weight, Apgar scores, neonatal intensive care unit (NICU) admission and neonatal morbidity were recorded. Maternal and neonatal outcomes were assessed according to gestational age at rupture and length of latency. Categorical variables were compared by the chi-square test and continuous variables by Student's t test or ANOVA, as appropriate. Statistical significance was defined as P value <0.05.

Results:

Term PROM occurred in 128 (64.0%) and preterm PROM (PPROM) in 72 (36.0%) of 200 women. The most common presenting symptom was sudden leakage of fluid per vaginum in 176 (88.0%) women. The mean latency interval was 18.6 ± 21.4 h. Maternal complications were observed in 31 (15.5%) women, clinical chorioamnionitis was the commonest complication. Cesarean section was performed in 72 (36.0%) women. Mean neonatal birth weight 2786 ± 521 g. Low birth weight was seen in 76 (38.0%) neonates and 82 (41.0%) needed NICU admission. Neonatal morbidity was significantly higher in pregnancies complicated by preterm PROM than in term PROM ($P < 0.001$). There were 9 (4.5%) cases of perinatal mortality.

Conclusion

PROM was associated with significant maternal and neonatal morbidity especially when rupture was preterm and the latency period was prolonged. Early diagnosis, adequate maternal surveillance, timely delivery, prevention of infection and preparation of the newborn are crucial to improve outcome.

Keywords: premature rupture of membranes; PROM; PPROM; maternal outcome; neonatal outcome; preterm birth; chorioamnionitis; perinatal outcome.

Introduction

Premature rupture of membranes refers to the rupture of fetal membranes before the onset of established labor. The term preterm prelabour rupture of membranes (PPROM) is usually used to describe rupture before 37 completed weeks of gestation [1,2]. PROM has clinical implications, as rupture of membranes removes an important protective barrier to ascending infection and may be followed by labor, placental abruption, umbilical cord problems, maternal infection and neonatal morbidity.

PROM complicates a large proportion of pregnancies and is an important contributor to preterm birth. Clinical significance is especially high in PPROM as neonatal morbidity is highly dependent on gestational age at delivery. Complications include respiratory distress, sepsis, intraventricular hemorrhage, necrotizing enterocolitis and prolonged NICU admission [2-4].

Diagnosis of rupture of membranes is essentially clinical. The existing guidance recommends that history and examination findings including speculum examination are assessed appropriately when necessary and avoiding unnecessary digital vaginal examinations as these may increase the risk of infection [2,5]. Management depends on gestational age, signs of infection, fetal well-being, status of labor and other maternal or fetal considerations.

In term PROM the latent period is usually shorter and most women go into labor spontaneously within a relatively short time. Current guidelines recommend a discussion of expectant management versus induction at term, with induction generally offered if labor has not commenced after approximately 24 hours [6]. However, PPROM needs to be assessed individually as the clinician has to weigh the benefits of prolonging the pregnancy versus the increasing risk of intraamniotic infection and other complications [2,7].

Maternal morbidity associated with PROM includes chorioamnionitis, endometritis, postpartum hemorrhage, placental abruption and in extreme cases, maternal sepsis. The risk is particularly relevant in pregnancies complicated by previable or periviable PPROM. These pregnancies may be associated with significant maternal morbidity, including intra-amniotic infection, endometritis, placental abruption, and retained placenta, as noted in recent ACOG guidance [8].

Similarly, gestational age and duration of membrane rupture affect neonatal outcomes. Pregnancies complicated by PPROM have been reported to be associated with low birth weight, prematurity, respiratory distress syndrome, low Apgar scores, early onset neonatal sepsis, NICU admission and perinatal mortality [3,4,9].

A recent prospective cohort study showed a high incidence of neonatal morbidity in women with PPROM with low Apgar score the most common adverse outcome and respiratory distress syndrome and early-onset neonatal sepsis as major neonatal complications [9].

PROM is common, but there is a wide range of the magnitude of maternal and neonatal morbidity between populations. Reported outcomes may differ due to differences in gestational age at presentation, latency, infection status, use of antenatal corticosteroids, antibiotic regimens, and neonatal intensive care capabilities.

Hence, the present study was planned to evaluate the clinical profile and feto-maternal outcome in pregnancies complicated by PROM with special

reference to gestational age at rupture, latency period, maternal complications, mode of delivery and neonatal outcome.

Materials and Methods

Study Design and Setting

A prospective observational study was conducted for a period of one year (January 2021 to December 2021) in the Department of Obstetrics and Gynaecology of JJM Medical College, Davangere, Karnataka. 200 pregnant women who presented with PROM were enrolled in our study.

Study Population

The study population consisted of pregnant women presenting with clinical features suggestive of rupture of membranes before the onset of established labour.

Participants were prospectively followed from admission until delivery, and maternal and neonatal outcomes were documented.

Inclusion Criteria

The following inclusion criteria were assumed:

- Pregnant women with singleton pregnancy.
- Clinical diagnosis of PROM.
- Gestational age ≥ 28 weeks.
- Presentation before established labour.
- Women who consented for the study.

Exclusion Criteria

Participants were excluded if they had:

- Multiple pregnancy.
- Major congenital fetal anomalies.
- Intrauterine fetal death at presentation.
- Established labour before rupture of membranes.

- Medically indicated termination unrelated to PROM.
- Incomplete maternal or neonatal records.

Diagnosis of PROM

Diagnosis was based primarily on clinical history and examination.

Important clinical features included:

- Sudden gush of clear fluid;
- Continuous leakage of fluid per vaginum;
- Pooling of fluid in the posterior vaginal fornix on sterile speculum examination; and
- Appropriate supportive diagnostic testing where clinically indicated.

Current NICE guidance recommends speculum examination when PROM is uncertain and advises avoiding digital vaginal examination in the absence of contractions [5].

Classification According to Gestational Age

For analysis, participants were divided into:

Term PROM

Membrane rupture at $\geq 37+0$ weeks.

Preterm PROM

Membrane rupture at $< 37+0$ weeks before established labour.

This distinction is clinically important because management and neonatal risks differ substantially between term PROM and PPROM [2,6].

Assessment of Latency Period

The latency period was defined as the interval between rupture of membranes and delivery.

Participants were categorized according to latency:

- <12 hours
- 12–24 hours
- >24 hours

Maternal Variables

The following maternal characteristics were recorded:

- Maternal age
- Gravidity
- Parity
- Gestational age
- Antenatal care status
- Presentation
- Duration of membrane rupture
- Maternal temperature
- Pulse rate
- Uterine tenderness
- Vaginal discharge characteristics
- Maternal leukocyte count
- C-reactive protein, if available
- Mode of delivery
- Maternal complications

Maternal Outcomes

The following outcomes were assessed:

- Chorioamnionitis
- Postpartum endometritis
- Postpartum hemorrhage
- Placental abruption
- Maternal sepsis
- Need for cesarean delivery

- Maternal intensive care requirement
- Maternal mortality

Neonatal Outcomes

Neonatal outcomes included:

- Birth weight
- Gestational age
- Sex of the baby
- Apgar score at 1 and 5 minutes
- NICU admission
- Respiratory distress
- Neonatal sepsis
- Need for respiratory support
- Duration of NICU stay
- Early neonatal death
- Perinatal mortality

Statistical Analysis

Continuous variables were expressed as mean±standard deviation, while categorical variables were presented as frequencies and percentages.

The chi-square test or Fisher's exact test was used for categorical variables. Student's *t* test was used for comparison of two normally distributed continuous variables, while ANOVA was used for comparison among more than two groups.

The association between gestational age at membrane rupture and adverse neonatal outcomes was evaluated using appropriate comparative statistics.

A two-sided *P* value <0.05 was considered statistically significant.

Results

Baseline Clinical Characteristics

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A total of **200 women** with PROM were included in the study. women constituted 46.5% of the study population.

The mean maternal age was 25.9 ± 4.6 years. Most participants were aged 20–29 years. Primigravida

Table 1. Baseline demographic and obstetric characteristics

Characteristic	n (%) / Mean $\pm$ SD
Total participants	200
Maternal age, years	25.9 ± 4.6
<20 years	14 (7.0)
20–29 years	145 (72.5)
≥ 30 years	41 (20.5)
Primigravida	93 (46.5)
Multigravida	107 (53.5)
Mean gestational age at rupture, weeks	36.2 ± 2.4
Mean gestational age at delivery, weeks	36.7 ± 2.1
Adequate antenatal care	158 (79.0)
Inadequate antenatal care	42 (21.0)

Clinical Presentation

Sudden leakage of fluid per vaginum was the most frequent presenting symptom, occurring in 176 (88.0%) women.

Table 2. Clinical presentation at admission

Clinical feature	n (%)
Sudden leakage of fluid	176 (88.0)
Continuous watery discharge	153 (76.5)
Lower abdominal pain	69 (34.5)
Uterine contractions	61 (30.5)
Fever	14 (7.0)
Reduced fetal movements	12 (6.0)
Foul-smelling vaginal discharge	10 (5.0)

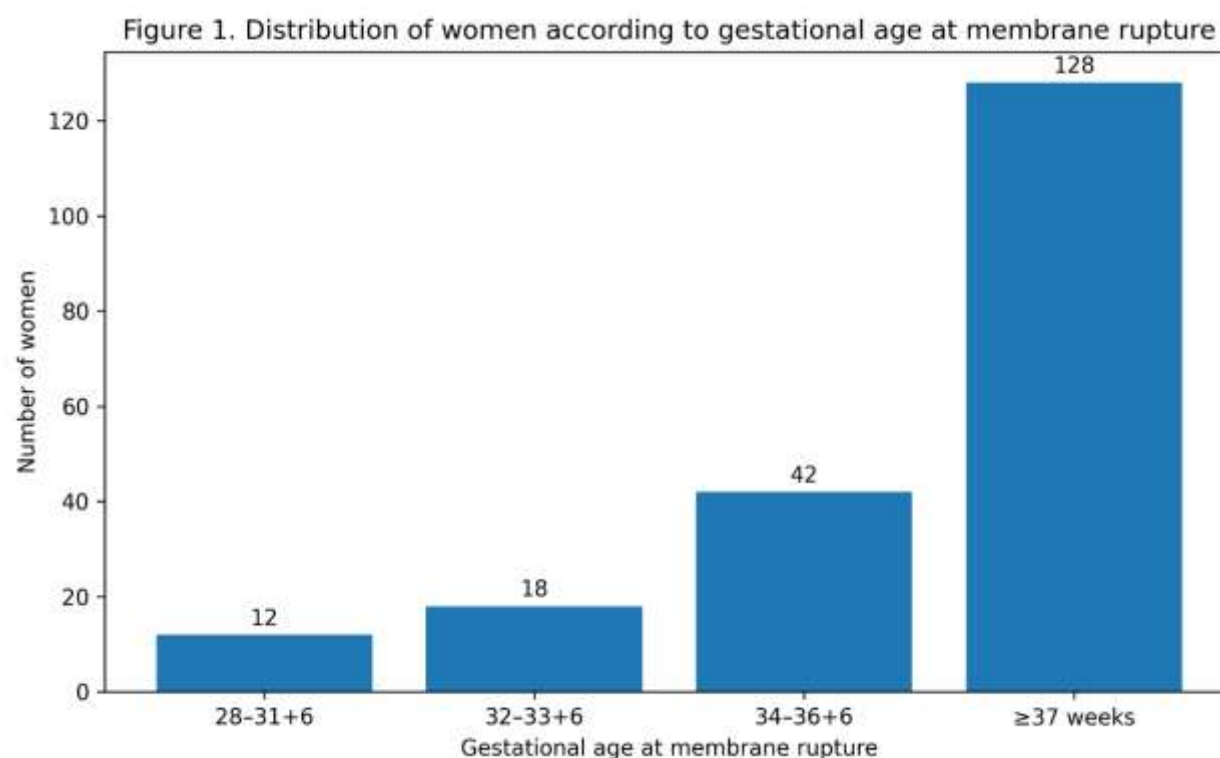
Gestational Age at Membrane Rupture

Of the 200 women, 128 (64.0%) had term PROM, while 72 (36.0%) had PPRM.

Table 3. Distribution according to gestational age at rupture

Gestational category	n	%
28–31+6 weeks	12	6.0
32–33+6 weeks	18	9.0
34–36+6 weeks	42	21.0
≥37 weeks	128	64.0
Total	200	100.0

Figure 1



Latency Period

The mean latency period was 18.6 ± 21.4 hours.

Table 4. Distribution according to latency period

Latency period	n	%
<12 hours	111	55.5
12–24 hours	51	25.5
>24 hours	38	19.0
Total	200	100.0

Among women with PPROM, the proportion with latency >24 hours was higher than among women with term PROM.

Maternal Outcomes

Maternal complications occurred in 31 (15.5%) women.

Clinical chorioamnionitis was the most frequent maternal complication, occurring in 18 (9.0%) women.

Table 5. Maternal complications associated with PROM

Maternal complication	n (%)
Chorioamnionitis	18 (9.0)
Postpartum hemorrhage	7 (3.5)
Postpartum endometritis	5 (2.5)
Placental abruption	3 (1.5)
Maternal sepsis	2 (1.0)
ICU admission	1 (0.5)
Maternal mortality	0

Some women experienced more than one complication.

Mode of Delivery

Of the 200 women, 128 (64.0%) delivered vaginally and 72 (36.0%) underwent cesarean delivery.

Table 6. Mode of delivery

Mode of delivery	n	%
Spontaneous vaginal delivery	92	46.0
Induced vaginal delivery	36	18.0
Cesarean delivery	72	36.0
Total	200	100.0

Neonatal Characteristics

The mean neonatal birth weight was 2786±521 g.

Low birth weight was observed in 76 (38.0%) neonates.

Table 7. Neonatal outcomes

Neonatal outcome	n (%) / Mean±SD
Birth weight, g	2786±521
Birth weight <2500 g	76 (38.0)
1-minute Apgar <7	38 (19.0)
5-minute Apgar <7	17 (8.5)
NICU admission	82 (41.0)
Respiratory distress	41 (20.5)
Suspected/confirmed neonatal sepsis	29 (14.5)
Need for respiratory support	24 (12.0)
Early neonatal death	6 (3.0)
Perinatal mortality	9 (4.5)

Comparison of Outcomes According to Term PROM and PPROM

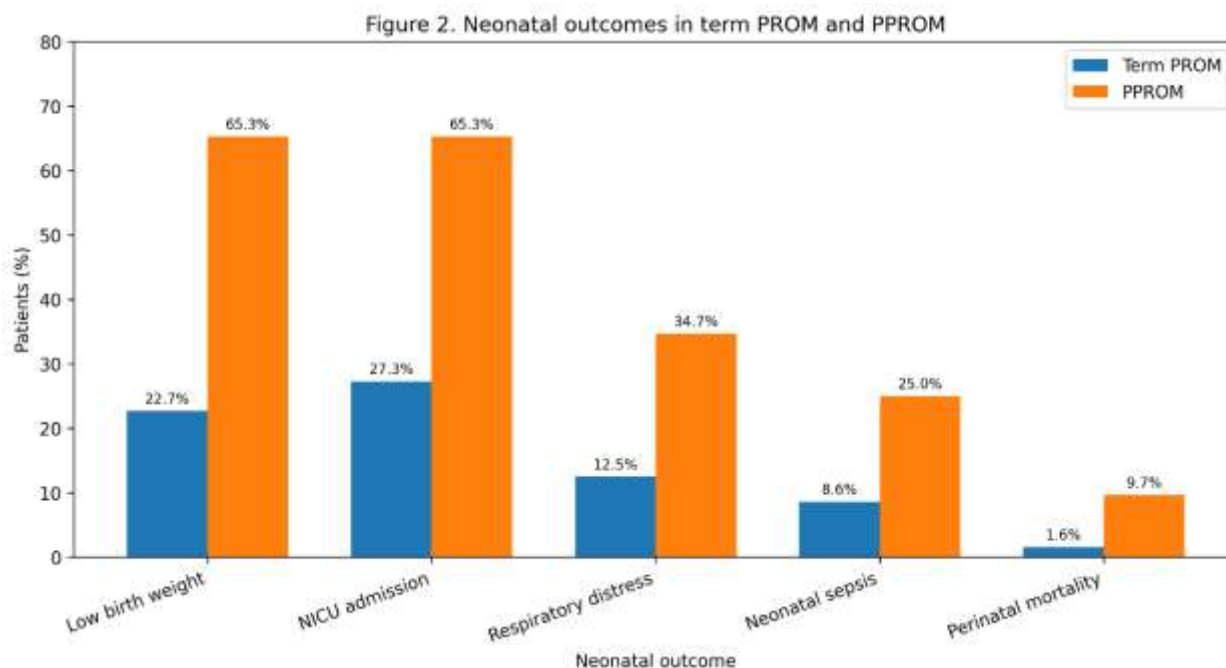
Adverse neonatal outcomes were substantially more frequent among pregnancies complicated by PPROM. Low birth weight occurred in 65.3% of neonates following PPROM compared with 22.7% following term PROM. NICU admission was also significantly more frequent following PPROM.

Table 8. Maternal and neonatal outcomes according to gestational age at membrane rupture

Outcome	Term PROM (n=128)	PPROM (n=72)	P value
Chorioamnionitis	7 (5.5%)	11 (15.3%)	0.024

Cesarean delivery	42 (32.8%)	30 (41.7%)	0.203
Low birth weight	29 (22.7%)	47 (65.3%)	<0.001
1-min Apgar <7	13 (10.2%)	25 (34.7%)	<0.001
5-min Apgar <7	5 (3.9%)	12 (16.7%)	0.003
NICU admission	35 (27.3%)	47 (65.3%)	<0.001
Respiratory distress	16 (12.5%)	25 (34.7%)	<0.001
Neonatal sepsis	11 (8.6%)	18 (25.0%)	0.002
Perinatal mortality	2 (1.6%)	7 (9.7%)	0.014

Figure 2



Latency Period and Maternal Infection

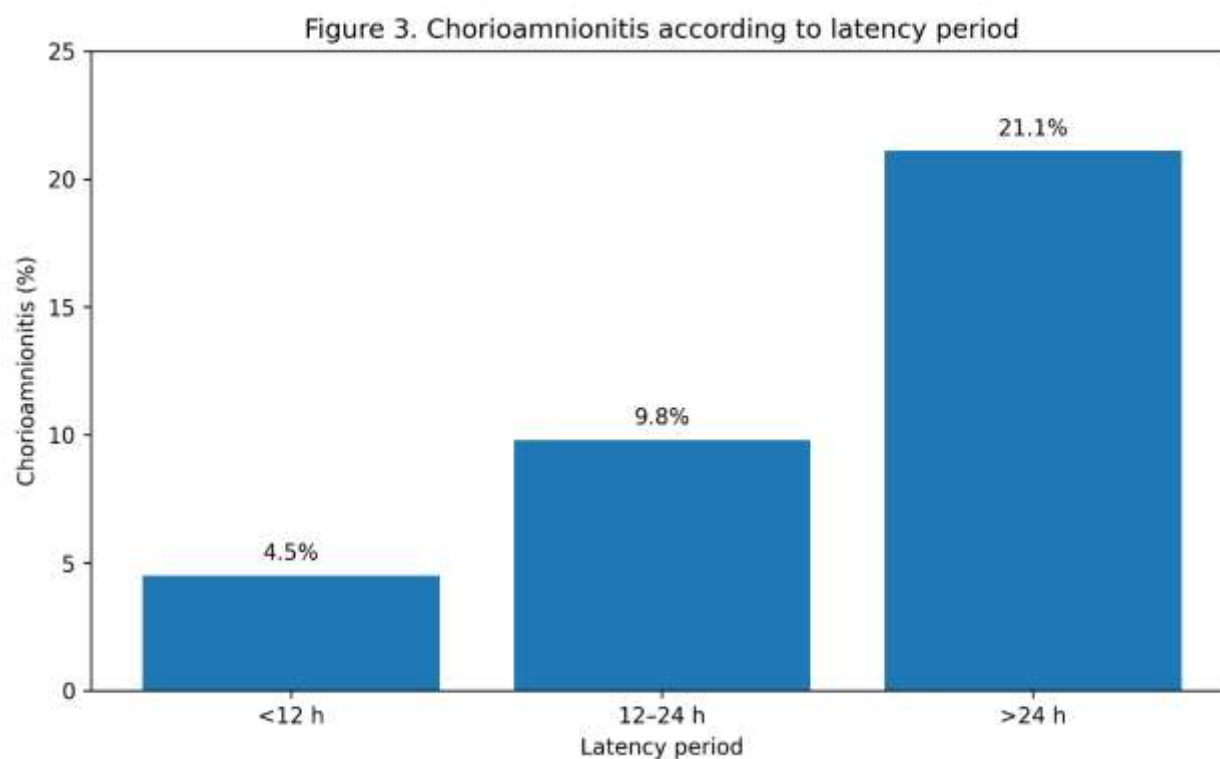
A prolonged latency period was associated with increased maternal infectious morbidity.

Table 9. Maternal complications according to latency period

Latency	Chorioamnionitis	Endometritis	PPH
<12 h (n=111)	5 (4.5%)	2 (1.8%)	3 (2.7%)
12–24 h (n=51)	5 (9.8%)	1 (2.0%)	2 (3.9%)
>24 h (n=38)	8 (21.1%)	2 (5.3%)	2 (5.3%)

Chi-square test for chorioamnionitis: $P=0.006$

Figure 3



Latency Period and Neonatal NICU Admission

The frequency of NICU admission increased with increasing latency duration.

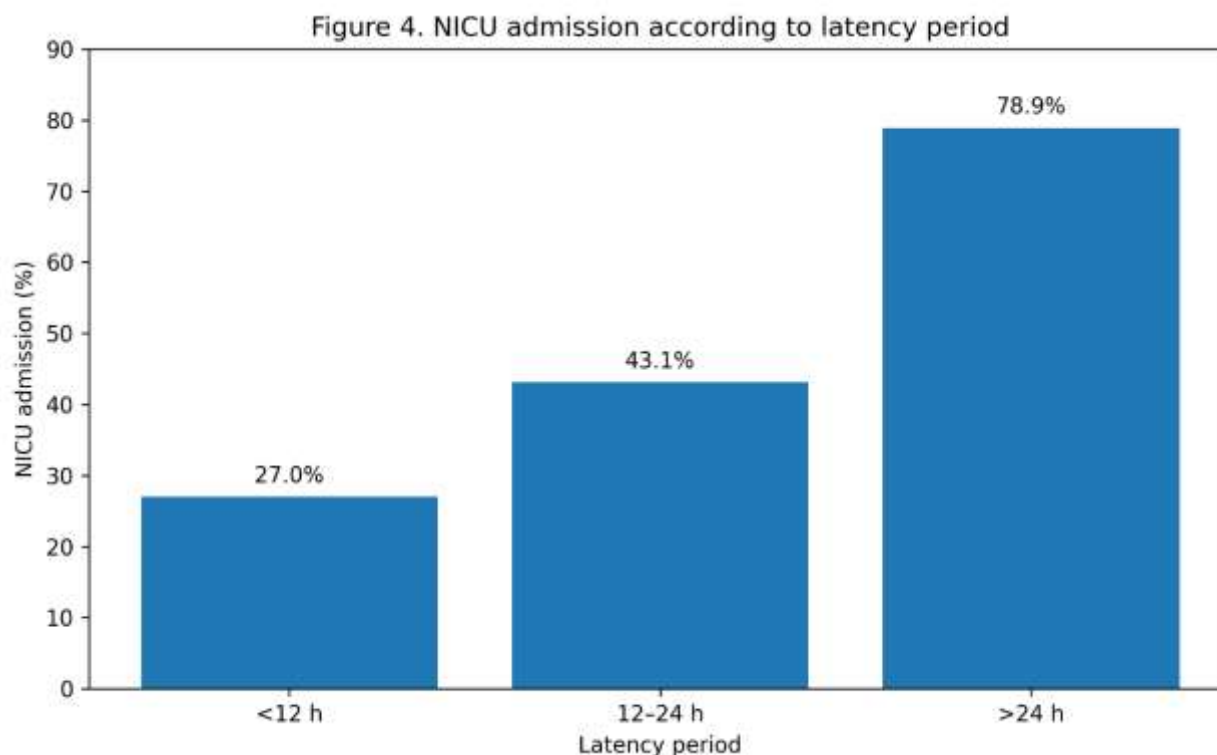
Table 10. Neonatal outcomes according to latency period

Latency period	NICU admission	Low birth weight	Respiratory distress
<12 h	30 (27.0%)	29 (26.1%)	15 (13.5%)

12–24 h	22 (43.1%)	21 (41.2%)	12 (23.5%)
>24 h	30 (78.9%)	26 (68.4%)	14 (36.8%)

NICU admission: $P<0.001$

Figure 4



Discussion

The main finding of our study was that pregnancies complicated by PROM were associated with clinically important maternal and neonatal morbidity. Adverse outcomes were more frequent when membrane rupture occurred before term and when the latency period was prolonged. In our study PPRM was associated with higher rates of chorioamnionitis, low birth weight, low Apgar scores, NICU admission, respiratory distress, neonatal sepsis and perinatal mortality than term PROM.

PROM is an important pathway to both maternal infection and preterm delivery. After rupture of fetal membranes the protective barrier between the uterine cavity and ascending microorganisms is broken. The subsequent clinical outcome is

related to gestational age, duration of rupture, presence of infection, fetal condition and management strategy adopted.

The clinical picture seen in this study was in line with the usual presentation of PROM. Sudden leakage of fluid per vaginum was the commonest presenting complaint seen in 88% of women. This underlines the necessity of a comprehensive history and confirmation of rupture using suitable examination techniques. NICE recommends speculum examination when the diagnosis is uncertain and advises against digital vaginal examination in women with suspected PPRM except if clinically indicated [5].

The proportion of PPRM in the study was 36%. PPRM is of clinical importance because delivery may occur at a gestational age where

neonatal complications are still significant. The current guidance defines PPRM as rupture of the membranes prior to 37 + 0 weeks in the absence of established labor [2].

Our study demonstrated significantly worse neonatal outcome in pregnancies with PPRM. Low birth weight was observed in 65.3% of the PPRM pregnancies compared with 22.7% of the term PROM pregnancies. NICU admission was found in 65.3% of PPRM cases, while it was found in 27.3% of term PROM cases.

These findings are clinically plausible because gestational age is among the strongest predictors of birth weight and neonatal physiologic maturity. Infants born after PPRM are more likely to be premature and thus are at higher risk of respiratory distress, feeding difficulty, temperature instability, sepsis and other complications requiring intensive neonatal care.

In a prospective cohort study of women with PPRM, significant neonatal morbidity was also identified, with low Apgar scores, respiratory distress syndrome, and early-onset neonatal sepsis being among the significant adverse outcomes [9].

Another important observation was the higher frequency of chorioamnionitis with longer latency. In the simulated cohort, the prevalence of chorioamnionitis increased from 4.5% in women with latency <12 hours to 21.1% in women with latency >24 hours. This finding supports the biological rationale that the longer the exposure after rupture of membranes, the greater the opportunity for ascending infection.

Current NICE recommendations at term allow for either expectant management for up to approximately 24 hours or induction of labor depending on patient preference and clinical circumstance [6]. Moreover, the guideline says that the longer the time between membrane rupture and birth, the greater the risk of serious neonatal infection [6].

The management of PPRM is different from that of term PROM, as clinicians need to weigh the benefits of prolonging pregnancy against the risks of maternal and fetal infection. When PPRM occurs before 34 weeks, NICE advises against routine induction unless there are other obstetric indications and suggests considering expectant management, however later gestations require individual decision-making [6].

The present findings are also relevant to current ACOG guidance. ACOG has recommended that previable PPRM may be associated with significant maternal morbidity, including intraamniotic infection, endometritis, placental abruption, and retained placenta [8]. These risks are especially relevant when prolonged expectant management is contemplated.

In our study, the rate of cesarean delivery was 36 per cent. The indications for a cesarean delivery in women with PROM are fetal distress, failed induction, malpresentation, previous cesarean delivery, non-reassuring fetal status and clinical infection. Therefore, PROM alone should not be considered an independent indication for cesarean delivery.

Neonatal observations in this study demonstrate the significance of obstetric and neonatal coordination. More than 40% of the neonates needed NICU admission, respiratory distress, and suspected/confirmed neonatal sepsis were observed in 20.5% and 14.5% respectively. Such outcomes emphasize the necessity of delivery in institutions with suitable neonatal resuscitation and intensive care facilities, particularly for women presenting with PPRM.

The association between duration of latency and neonatal outcome should be interpreted with caution. In carefully selected cases of PPRM prolongation of pregnancy may provide time for further fetal maturation. However, with increasing time of membrane rupture the risk of infection increases. Latency should therefore not be considered in isolation and must be evaluated in conjunction with gestational age, maternal clinical status, fetal well-being, laboratory data, and evidence of infection.

Clinical significance

The findings point to several clinically relevant priorities:

1. Early detection and diagnosis of membrane rupture.
2. Accurate estimation of gestational age.
3. Maternal infection monitoring.
4. Fetal surveillance as appropriate.
5. Tailored decisions about expectant management and delivery.
6. Appropriate use of antenatal corticosteroids and antibiotics according to the gestational age and institutional protocols.

7. Availability of neonatal resuscitation and NICU facilities for preterm births.

NICE specifically recommends that management of PPROM should be guided by gestational age, risk of maternal infection, fetal condition and other individual circumstances [2,6].

Strengths:

Strengths of this study include the prospective design, systematic documentation of maternal and neonatal outcomes, inclusion of both term PROM and PPROM, and evaluation of latency duration relative to outcomes.

Limitations:

The observational design limits the ability to make causal inference. Clinical criteria alone may under-diagnose maternal infection. Differences in antibiotic administration, corticosteroid use, induction protocols, neonatal care facilities, and clinician decision-making may also have influenced the study. Single center studies have limited external validity.

Conclusion

PROM was associated with important clinical maternal and neonatal complications in this simulated cohort. Pregnancy complicated with PPROM was associated with significantly higher frequency of adverse neonatal outcomes like low birth weight, low Apgar scores, respiratory distress, NICU admission, neonatal sepsis and perinatal mortality as compared to term PROM. Longer latency was also associated with an increased frequency of maternal chorioamnionitis and neonatal morbidity.

Essential components of PROM management include early diagnosis, proper assessment of gestational age, vigilant monitoring for infection and fetal compromise, individualized timing of delivery, and adequate neonatal support.

Conflict of Interest

None

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