OPEN ACCESS

Scholars International Journal of Obstetrics and Gynecology

Abbreviated Key Title: Sch Int J Obstet Gynec
ISSN 2616-8235 (Print) |ISSN 2617-3492 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Preterm Prelabour Rupture of Membranes (PPROM): Evaluation of Risk Factors and Pregnancy Outcome in a Tertiary Level Hospital

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DOI: https://doi.org/10.36348/sijog.2026.v09i09.005 | **Received:** 12.07.2026 | **Accepted:** 05.09.2026 | **Published:** 09.09.2026

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Abstract

Background: Preterm prelabour rupture of membranes (PPROM) is an important obstetric complication associated with maternal morbidity, prematurity and adverse neonatal outcomes. Identification of associated risk factors and assessment of pregnancy outcomes are essential for improving maternal and neonatal care. ***Objective:*** To evaluate the potential risk factors and pregnancy outcomes among women with PPROM admitted to a tertiary-level hospital. ***Methods:*** A descriptive observational study was conducted in the Department of Obstetrics & Gynaecology, Shaheed Suhrawardy Medical College Hospital, Dhaka, Bangladesh, over six months from 27 February 2019 to 26 August 2019. Fifty pregnant women with PPROM between 28 and 36^{+6} weeks of gestation were enrolled consecutively and followed until delivery. Sociodemographic characteristics, obstetric history, clinical presentation, potential risk factors, mode of delivery, maternal complications and neonatal outcomes were recorded and analyzed using descriptive statistics. ***Results:*** The mean maternal age was 23.5 ± 9.54 years, and 42.0% were aged 21–25 years. Most women were multigravida (62.0%) and presented at 34–36^{+6} weeks (74.0%). Anaemia (28.0%), urinary tract infection (26.0%) and previous caesarean section (24.0%) were the most frequently identified potential risk factors. Caesarean section was performed in 82.0% of cases. Urogenital infection (34.0%) was the most common maternal complication. All newborns were premature, while neonatal sepsis occurred in 30.0% and birth asphyxia in 24.0%. Neonatal mortality was 8.0%. ***Conclusion:*** PPROM was associated with substantial maternal and neonatal morbidity. Early identification of associated factors, appropriate antenatal care, prompt management and adequate neonatal support are important to improve outcomes.

Keywords: Preterm prelabour rupture of membranes; PPROM; Risk factors; Pregnancy outcome; Neonatal outcome.

INTRODUCTION

Preterm prelabour rupture of membranes (PPROM) is defined as rupture of the fetal membranes before the onset of labour and before 37 weeks of gestation, with rupture occurring after the period of fetal viability but prior to term. It is an important obstetric complication, occurring in approximately 3% of pregnancies and contributing to nearly 30–40% of preterm births.[1] PPROM is therefore a major contributor to perinatal morbidity and mortality, particularly in settings where access to advanced maternal and neonatal care is limited. The clinical significance of PPROM depends largely on gestational age at membrane rupture, duration of membrane rupture, presence of intra-amniotic infection, and the availability of appropriate obstetric and neonatal interventions.

The aetiology of PPROM is multifactorial and involves a complex interaction between maternal, fetal, placental and environmental factors. Normal fetal membranes maintain considerable tensile strength

through their collagen-rich connective tissue structure. Disruption of collagen synthesis, degradation, or cross-linking may reduce membrane strength and predispose to premature rupture.[2] Maternal smoking and nutritional deficiencies, particularly of zinc, copper and ascorbic acid, have been associated with impaired collagen cross-linking and increased membrane fragility. [2] Other recognized predisposing factors include previous PPROM or preterm birth, genital tract infection, antepartum bleeding, polyhydramnios, multiple pregnancy, cervical abnormalities, uterine overdistension, trauma and associated maternal comorbidities. Identification of these risk factors is important because recognition of women at increased risk may facilitate closer antenatal surveillance and earlier intervention.

Intra-amniotic infection and inflammation are particularly important mechanisms implicated in PPROM. Microorganisms associated with intrauterine infection may produce proteolytic enzymes capable of weakening the fetal membranes. In addition, the maternal inflammatory response induces cytokines and prostaglandins, which can increase collagen degradation and uterine activity, ultimately contributing to membrane rupture and preterm delivery.[3] Once the membranes have ruptured, the loss of the protective barrier increases the risk of ascending infection and chorioamnionitis. Intra-amniotic infection is associated with earlier delivery and adverse neonatal outcomes, while neonatal sepsis carries substantially increased mortality compared with infants without sepsis.[4]

Accurate diagnosis of PPROM is essential for appropriate management and assessment of pregnancy outcome. The diagnosis is primarily based on maternal history and sterile speculum examination demonstrating amniotic fluid within the vagina. The history of a sudden gush or continuous leakage of fluid is highly suggestive of membrane rupture.[5] When clinical examination is inconclusive, additional diagnostic tests such as nitrazine testing, fern testing, insulin-like growth factor binding protein-1 (IGFBP-1) or placental alpha-microglobulin-1 (PAMG-1) assays may assist in confirming the diagnosis. Ultrasonography can provide supportive evidence by assessing amniotic fluid volume and fetal wellbeing, although it should be interpreted in conjunction with clinical findings.[6] Maternal temperature, white blood cell count, C-reactive protein and fetal heart rate monitoring may assist in evaluating intra-amniotic infection, but no single parameter should be used in isolation.[1]

PPROM is associated with substantial maternal and neonatal complications. Important fetal and neonatal consequences include prematurity, respiratory distress syndrome, neonatal sepsis, pulmonary hypoplasia, umbilical cord prolapse, placental abruption and fetal death.[3] Maternal complications may include chorioamnionitis, postpartum endometritis, maternal sepsis and, in severe cases, disseminated intravascular coagulation. The risk of these complications varies according to gestational age at rupture, latency period and the presence or absence of infection. Earlier gestational age at delivery is also an important determinant of neonatal birth weight, respiratory morbidity and survival.[7]

Management of PPROM is primarily determined by gestational age, fetal condition, evidence of infection, labour and other obstetric indications. In clinically stable women without contraindications to continuing pregnancy, expectant management may be undertaken to allow further fetal maturation. Antenatal corticosteroids are recommended for eligible women at risk of preterm birth, as they reduce important complications of prematurity, particularly respiratory distress syndrome and intraventricular haemorrhage.[8-10] Antibiotic therapy can prolong the latency period and reduce infectious morbidity in appropriate cases. However, prolonged pregnancy in the presence of infection or fetal/maternal compromise may increase adverse outcomes, necessitating timely delivery. [9-11]

Given the multifactorial nature of PPROM and its significant impact on both maternal and neonatal health, evaluation of associated risk factors and pregnancy outcomes is clinically important. Data from tertiary-level hospitals can help identify prevalent risk factors, determine the frequency of maternal and fetal complications, and assess outcomes according to gestational age and clinical characteristics. Therefore, the present study was undertaken to evaluate the risk factors associated with PPROM and assess pregnancy outcomes among women presenting with PPROM at a tertiary-level hospital.

Objectives

The main objective was to evaluate the risk factors associated with preterm prelabour rupture of membranes (PPROM) and assess pregnancy outcomes among women with PPROM presenting to a tertiary-level hospital.

METHODOLOGY & MATERIALS

The descriptive observational study will be conducted in the Department of Obstetrics & Gynaecology, Shaheed Suhrawardy Medical College Hospital, Dhaka, Bangladesh. The study will be carried out over a period of six months, from February 2019 to August 2019.

Inclusion Criteria:

- Pregnant women with PPROM
- Both primigravid and multigravid women
- Gestational age between 28^{0} and 36^{+6} weeks
- Spontaneous rupture of membranes occurring before the onset of established labour
- Women willing to participate in the study

- Women who provide informed written consent to participate in the study

Exclusion Criteria:

- Women presenting with rupture of membranes with established labour
- Women with rupture of membranes associated with antepartum haemorrhage
- Women with severe pre-eclampsia or eclampsia
- Women with malpresentation
- Women with gestational age ≥37 weeks
- Women with any maternal or obstetric condition requiring immediate delivery independent of PPROM

A total of 50 pregnant women diagnosed with PPROM will be enrolled consecutively during the study period. After enrolment, all participants will be evaluated from the time of presentation until delivery to assess potential risk factors and maternal and neonatal pregnancy outcomes. Baseline demographic and obstetric characteristics, including maternal age, residence, gravidity and gestational age at presentation, will be recorded.

Following admission, the diagnosis of PPROM will be established based on a history of spontaneous leakage of amniotic fluid before the onset of established labour and clinical confirmation by sterile speculum examination. The nature of membrane rupture, including continuous leakage or sudden gush of fluid, will be documented. The time elapsed between the onset of membrane rupture and hospital presentation will also be recorded and categorized as ≤1 hour, 2–6 hours, 7–12 hours and >12 hours.

Potential risk factors associated with PPROM will be assessed through detailed history, physical examination and review of available medical records. These will include anaemia, urinary tract infection, previous caesarean section, absence of antenatal care, polyhydramnios, previous history of preterm labour, previous postpartum haemorrhage, vulvovaginitis and multiple pregnancy. Relevant clinical findings at presentation, including fever, lower abdominal pain, reduced fetal movement, foul-smelling vaginal discharge, uterine tenderness, fetal distress, maternal tachycardia and leukocytosis, will also be documented.

Participants will be followed until delivery. Maternal and fetal conditions will be monitored during the hospital stay, and management will be provided according to gestational age, maternal and fetal condition and the clinical judgment of the attending obstetrician. The interval between membrane rupture and delivery, mode of delivery and maternal complications will be recorded. Maternal pregnancy outcomes will include vaginal delivery, caesarean section, urogenital infection, wound infection, puerperal sepsis, postpartum haemorrhage and maternal mortality.

Following delivery, neonatal outcomes will be assessed and recorded. These will include birth weight, Apgar scores at 1 and 5 minutes, neonatal sepsis, birth asphyxia, hyperbilirubinaemia, stillbirth, congenital anomaly and neonatal death. Birth weight will be categorized as <1.5 kg, 1.6–2.0 kg, 2.1–2.5 kg and >2.5 kg. Apgar scores will be categorized as 7–10, 4–6 and <4 at both 1 and 5 minutes. The need for immediate neonatal resuscitation and transfer to neonatal intensive care, where applicable, will also be documented.

Data will be collected using a structured preformed data collection sheet. Maternal demographic characteristics, obstetric history, gestational age, clinical presentation, duration of membrane rupture, potential risk factors, mode of delivery, maternal complications and neonatal outcomes will be recorded systematically. The primary outcome will be pregnancy outcome following PPROM, including maternal and neonatal complications and mortality. The secondary outcome will be the identification and frequency of potential maternal, obstetric and clinical risk factors among women with PPROM.

Ethical approval will be obtained from the appropriate Ethical Review Committee of Shaheed Suhrawardy Medical College Hospital before commencement of the study. Informed written consent will be obtained from all participants before enrolment. Participation will be voluntary, and participants will be allowed to withdraw from the study at any time without affecting their routine medical care. Confidentiality of participant information will be strictly maintained, and collected data will be used solely for research purposes.

Statistical Analysis:

Data were entered and analyzed using SPSS version 25. Quantitative variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. Descriptive statistics were used to summarize demographic, obstetric, clinical, risk-factor and maternal and neonatal outcome data. A p-value <0.05 was considered statistically significant. Confidentiality of all study-related information was maintained.

RESULT

Table 1: Sociodemographic and obstetric characteristics of women with PPROM (n=50)

Characteristics	Frequency (n)	Percentage (%)
Age group (years)		
16–20	8	16%
21–25	21	42%
26–30	12	24%
31–35	9	18%
Mean age (years)	23.5 ± 9.54	
Residence		
Urban	26	52%
Rural	19	38%
Suburban/slum	5	10%
Gravidity		
Primigravida	19	38%
Multigravida	31	62%
Gestational age (weeks)		
28–33	13	26%
34–36^{+6}	37	74%
Mean gestational age (weeks)	34.27 ± 4.82	

Table 1 shows the sociodemographic and obstetric characteristics of women with PPROM. The mean maternal age was 23.5 ± 9.54 years, with the highest proportion aged 21–25 years (42%). Most participants were from urban areas (52%) and were multigravida (62%). Regarding gestational age, 74% of women presented at 34–36^{+6} weeks, with a mean gestational age of 34.27 ± 4.82 weeks.

Table 2: Clinical presentation and time elapsed since membrane rupture among women with PPROM (n=50)

Clinical characteristics	Frequency (n)	Percentage (%)
Clinical presentation		
Lower abdominal pain	42	84%
Continuous leakage of fluid per vagina	32	64%
Fever	29	58%
Tachycardia	26	52%
Leukocytosis	23	46%
Reduced fetal movement	19	38%
History of gush of fluid per vagina	18	36%
Fetal distress	17	34%
Uterine tenderness	16	32%
Foul-smelling vaginal discharge	13	26%
Time elapsed since membrane rupture		
≤1 hour	6	12%
2–6 hours	24	48%
7–12 hours	11	22%
>12 hours	9	18%

Table 2 shows the clinical presentation and time elapsed since membrane rupture among women with PPROM. Lower abdominal pain was the most common presentation (84%), followed by continuous leakage of fluid per vagina (64%) and fever (58%). Regarding time elapsed since membrane rupture, 48% of women presented within 2–6 hours, while 18% presented after more than 12 hours.

Table 3: Potential risk-factor profile among women with PPROM (n=50)

Potential risk factors	Frequency (n)	Percentage (%)
Anaemia	14	28%
Urinary tract infection	13	26%
Previous caesarean section	12	24%
No antenatal care	9	18%

Potential risk factors	Frequency (n)	Percentage (%)
Polyhydramnios	7	14%
History of preterm labour	5	10%
Previous postpartum haemorrhage	5	10%
Vulvovaginitis	5	10%
Multiple pregnancy	2	4%

Table 3 shows the potential risk-factor profile among women with PPROM. Anaemia was the most common potential risk factor (28%), followed by urinary tract infection (26%) and previous caesarean section (24%). No antenatal care was reported in 18% of women, while polyhydramnios was present in 14% of cases.

Table 4: Maternal and pregnancy outcomes among women with PPROM (n=50)

Maternal/pregnancy outcome	Frequency (n)	Percentage (%)
Mode of delivery		
Vaginal delivery	9	18%
Caesarean section	41	82%
Postpartum complications		
Urogenital infection	17	34%
Wound infection	10	20%
Puerperal sepsis	8	16%
Postpartum haemorrhage	4	8%
No documented complication	7	14%
Maternal mortality	0	0

Table 4 shows the maternal and pregnancy outcomes among women with PPROM. Caesarean section was the predominant mode of delivery (82%), while 18% had vaginal delivery. Urogenital infection was the most common postpartum complication (34%), followed by wound infection (20%) and puerperal sepsis (16%). No maternal mortality was recorded.

Table 5: Neonatal outcomes among pregnancies complicated by PPROM (n=50)

Neonatal outcome	Frequency (n)	Percentage (%)
Birth weight		
<1.5 kg	7	14%
1.6–2.0 kg	13	26%
2.1–2.5 kg	21	42%
>2.5 kg	9	18%
Apgar score at 1 minute		
7–10	29	58%
4–6	14	28%
<4	7	14%
Apgar score at 5 minutes		
7–10	45	90%
4–6	3	6%
<4	2	4%
Neonatal complications		
Prematurity	50	100%
Neonatal sepsis	15	30%
Birth asphyxia	12	24%
Hyperbilirubinaemia	8	16%
Neonatal death	4	8%
Stillbirth	2	4%
Congenital anomaly	2	4%

Table 5 shows the neonatal outcomes among pregnancies complicated by PPROM. Most newborns had a birth weight of 2.1–2.5 kg (42%). An Apgar score of 7–10 was observed in 58% at 1 minute and 90% at 5 minutes. Prematurity occurred in all newborns, while neonatal sepsis (30%) and birth asphyxia (24%) were the most common complications. Neonatal death occurred in 8% of cases.

DISCUSSION

This study evaluated the potential risk factors and maternal and neonatal outcomes of PPROM among 50 pregnant women admitted to a tertiary-level hospital. The findings demonstrate that PPROM was predominantly observed among young women, multigravida women and those presenting during the late-preterm period. Anaemia, urinary tract infection and previous caesarean section were the most frequently identified potential risk factors. Considerable maternal and neonatal morbidity was also observed, particularly urogenital infection, neonatal sepsis, birth asphyxia and prematurity.

The mean maternal age was 23.5 ± 9.54 years, with the largest proportion (42.0%) belonging to the 21–25-year age group. This finding is consistent with previous studies reporting a predominance of PPROM among women in the early reproductive age group. A study from Patna Hospital, Nepal, reported that most women with PPROM were aged 20–24 years, while a Bangladeshi study similarly reported that 54% of affected women were 20–24 years old.[12] The predominance of younger women may partly reflect the reproductive age distribution of the population; however, maternal age alone is unlikely to explain PPROM because its aetiology is multifactorial.

Multigravida women constituted 62.0% of the study population, while 38.0% were primigravida. This finding is comparable with a previous Bangladeshi prospective study in which 59% of women with PPROM were multigravida.[12-35] Previous studies have reported inconsistent associations between parity and PPROM, with some suggesting increased risk with higher parity and others finding no significant independent relationship.[12-14] Thus, the predominance of multigravida women in the present study should be interpreted as a population characteristic rather than proof of an independent causal association.

Regarding potential risk factors, anaemia (28.0%), urinary tract infection (26.0%) and previous caesarean section (24.0%) were the most commonly identified. Anaemia and genitourinary infection are clinically relevant because nutritional deficiency and infection may compromise membrane integrity. Intrauterine infection can stimulate inflammatory cytokines and prostaglandins, increase collagen degradation and weaken the fetal membranes. [3-8] Previous studies have also identified infection, poor nutritional status and inadequate antenatal care among factors associated with PPROM.[15] However, because this study did not include a non-PPROM control group, these findings should be described as potential associated factors rather than statistically confirmed independent risk factors.

The clinical presentation was dominated by lower abdominal pain (84.0%), continuous leakage of fluid per vagina (64.0%) and fever (58.0%). Tachycardia and leukocytosis were also observed in a considerable proportion of women. These findings are clinically important because maternal fever, tachycardia, uterine tenderness and leukocytosis may accompany intra-amniotic infection or inflammation. Infection is an important concern in PPROM because disruption of the membranes facilitates ascending infection and may further contribute to membrane weakening and preterm delivery. [3,4]

The majority of women presented within 2–6 hours (48.0%) of membrane rupture, whereas 18.0% presented after more than 12 hours. Prolonged rupture of membranes may increase the opportunity for ascending infection and subsequent maternal and neonatal complications. Therefore, early recognition of membrane rupture and prompt hospital assessment remain important components of PPROM management.

Regarding pregnancy outcomes, 82.0% of women underwent caesarean section, while 18.0% delivered vaginally. This caesarean rate is higher than that reported in some previous studies, where vaginal delivery was more common. [12,14] Differences may be related to variations in gestational age, fetal distress, maternal infection, obstetric indications and institutional delivery practices. The presence of fetal distress in 34.0% of women in the present study may have contributed to the high operative delivery rate.

Maternal postpartum morbidity was also notable. Urogenital infection (34.0%) was the most common complication, followed by wound infection (20.0%) and puerperal sepsis (16.0%). Previous Bangladeshi studies have similarly reported urogenital infection, puerperal sepsis and wound infection among important maternal complications associated with PPROM. [12-14] Infection remains an important complication because prolonged membrane rupture facilitates ascending infection and may contribute to both maternal and neonatal morbidity. [3,4] Despite the observed morbidity, no maternal mortality occurred in this study.

The neonatal findings demonstrated a substantial burden of prematurity-related morbidity. All newborns were premature, while neonatal sepsis occurred in 30.0% and birth asphyxia in 24.0%. These findings are comparable with previous studies reporting neonatal infection and fetal distress as important complications following PPROM. A study conducted in Nepal reported fetal distress in approximately 24% of cases and neonatal infection in 24% of newborns. [6]

Birth weight also reflected the effect of preterm delivery. The largest proportion of newborns (42.0%) weighed 2.1–2.5 kg, while 14.0% weighed less than 1.5 kg. Only 18.0% weighed more than 2.5 kg. Previous studies have demonstrated that gestational age at delivery is an important determinant of neonatal birth

weight, survival and the requirement for neonatal resuscitation. [3,7] A Bangladeshi prospective study similarly reported that 38.4% of newborns weighed 2.1–2.5 kg and 10.3% weighed less than 1.5 kg. [12]

The Apgar findings showed improvement between the first and fifth minutes. At 1 minute, 42.0% of newborns had an Apgar score below 7, compared with only 10.0% at 5 minutes. This improvement may reflect successful initial stabilization and neonatal resuscitation. Nevertheless, birth asphyxia was documented in 24.0% of newborns. Prematurity, low birth weight, fetal distress and neonatal infection may all contribute to poor immediate neonatal adaptation.

The neonatal mortality rate was 8.0%, while stillbirth occurred in 4.0% of cases. These findings highlight the considerable perinatal burden associated with PPROM, particularly in settings where premature newborns may require specialized neonatal care. The results emphasize the importance of timely diagnosis, appropriate maternal monitoring, management of infection, obstetric decision-making and availability of adequate neonatal care facilities.

Overall, the findings suggest that PPROM is associated with substantial maternal and neonatal morbidity. The frequent occurrence of anaemia, urinary tract infection and inadequate antenatal care-related characteristics highlights the importance of strengthening antenatal surveillance and early management of maternal infections and nutritional problems. The high frequency of neonatal sepsis, birth asphyxia, low birth weight and neonatal death further emphasizes the need for timely referral and appropriate neonatal support.

Limitations of the study

This study had some limitations. It was conducted at a single tertiary-level hospital with a relatively small sample size of 50 participants, which may limit the generalizability of the findings. The absence of a non-PPROM control group prevented assessment of the independent association between potential risk factors and PPROM. The short six-month study period may also have limited the representation of seasonal and long-term variations. In addition, some neonatal outcomes could not be followed completely because of limitations in the available neonatal care facilities.

CONCLUSION

PPROM was associated with considerable maternal and neonatal morbidity in this study. Anaemia, urinary tract infection and previous caesarean section were the most frequently identified potential risk factors. Caesarean delivery was predominant, while urogenital infection was the most common maternal complication. Among neonates, prematurity, neonatal sepsis, birth asphyxia and low birth weight were prominent adverse outcomes, with 8% neonatal mortality. These findings emphasize the importance of adequate antenatal care, early identification and treatment of maternal infections and anaemia, timely diagnosis of PPROM, appropriate obstetric management and availability of adequate neonatal care to improve maternal and perinatal outcomes.

Funding: No funding sources.

Conflicts of interest: There are no conflicts of interest.

Ethical approval: The study was approved by the Institutional Ethics Committee.

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