International Journal of Research in Medical Sciences
Thapa A et al. Int J Res Med Sci. 2023 Jun;11(6):2090-2097
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20231623

Original Research Article

Fetal and maternal outcomes and risk factors associated with preterm prelabour rupture of membrane

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Received: 30 March 2023
Accepted: 04 May 2023

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ABSTRACT

Background: This study aimed to assess the fetomaternal outcome of preterm prelabour rupture of membranes (PPROM) and identify the risk factors associated with this condition.
Methods: The study was conducted in the Obstetrics and Gynecology department of Fakhruddin Ali Ahmed Medical College and Hospital, Barpeta, Assam, and used a hospital-based prospective observational study design. The study duration was 12 months from September 2021 to August 2022, and the sample size was 80.
Results: The study found that the majority of respondents were between the ages of 20-25, Hindu, and unemployed. The occurrence of PPROM was most frequent in women between 35-36 weeks of gestation, with 41 patients (51.25%) affected. Approximately 57.50% of the study participants presented to the medical facility within 6 hours of experiencing vaginal discharge.
Conclusions: Although PPROM is a common pregnancy complication, its consequences can be avoided by using antibiotics, corticosteroids, and other medications. The majority of the mothers had no risk factors. The study's findings may help healthcare providers to better understand the risk factors associated with PPROM and develop interventions to improve maternal and fetal outcomes.

Keywords: Antibiotics, Fetal outcome, Maternal outcome, PPROM, Risk factor

INTRODUCTION

Pregnancy is regarded as a unique, physiologically normal event in a woman's life. Although the majority of pregnancies and births are uneventful, not all pregnancies are risk-free. Around 15% of all pregnant women experience potentially life-threatening complications, necessitating major obstetrical interventions to survive.[1]

The World Health Organization (WHO) defined normal labour as "spontaneous in onset, low-risk at the start of labour and remaining so throughout labour and delivery. The infant is born spontaneously in the vertex position between 37 to 42 completed weeks of pregnancy. After birth, mother and infant are in good condition".[2]

Preterm labour (PTL) is defined by the World Health Organization (WHO) as "the onset of labour after the period of viability that is after 28 weeks of gestation and before 37 completed weeks or 259 days of pregnancy". Based on gestational age, preterm births can be sub-categorized as: extremely preterm (less than 28 weeks), very preterm (28 to 32 weeks) andmoderate to late preterm (32 to 37 weeks).

An estimated 15 million babies are born prematurely every year, which is more than 1 in 10 babies. India had 3,519,100 preterm births in 2010.[3] Significant perinatal morbidity and mortality rates are linked to pre-term birth. Approximately 1 million children die each year due to complications related to preterm birth.[4] Learning

difficulties, vision and hearing issues, and other disabilities are common among survivors.

Preterm birth is a syndrome with several different contributing factors that can be divided into two main subtypes: i) spontaneous preterm birth (spontaneous commencement of labour or after premature prelabour rupture of membranes (PPROM)) and ii) provider-initiated preterm delivery (defined as the induction of labour or elective caesarean birth before 37 completed weeks of gestation for maternal or foetal causes, or other non-medical reasons).

Because symptoms or signs may only slightly deviate from the typical physiological symptoms and signs of pregnancy, early diagnosis of preterm labour or preterm rupture of the membranes in routine antenatal care is challenging. Therefore, specific recommendations are needed to screen for or treat pre-term labour. Better maternal and perinatal outcomes are the result of an organised and methodical approach to labour management.[5,6]

Prelabour rupture of membrane (PROM) is defined as spontaneous rupture of the membranes any time after the 28th week of pregnancy but before the onset of labour. When rupture of the membrane occurs beyond the 37th week but before the onset of labour it is known as term PROM and when it occurs before 37completed weeks, it is called preterm PROM (PPROM).[7]

PPROM is a multi-faceted process with risk components such as PPROM in a previous pregnancy, previous episodes of preterm labour, prior history of cervical conization, cervical cerclage, infections, amniocentesis, polyhydramnios and multifetal gestation, smoking, socioeconomic status, poverty and nutritional deficiencies, but in most cases the cause is unknown.[8]

At term, foetal membrane rupture is a normal physiological process, but when it occurs prematurely it is due to abnormal structural weakening of the membranes, which is caused by membrane stretch and entails local inflammation as well as ascending bacterial colonisation. Bacterial collagenases and other enzymes directly cause membrane deterioration. A variety of other pathways such as increased maternal cytokines or an imbalance in MMPs and TIMPs in response to microbial colonisation, trauma and uterine over-distension are all factors to consider. Genital tract pathogens such as *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, *Trichomonas vaginalis*, and Group B *Streptococcus* (GBS) have been associated with PPROM.

PPROM is linked to numerous neonatal and maternal complications such as neonatal sepsis and HMD, placental abruption and ultimately fetal death. 1-2% risk of fetal death is associated with PPROM. Furthermore, PPROM places the mother at risk of infection (chorioamnionitis) and preterm delivery as well as increases the risk of caesarean section delivery.[9]

Obstetricians face difficulty while treating preterm pre-labour rupture of the membranes (PPROM), which is a significant clinical issue. On the one hand, waiting for the spontaneous onset of labour (expectant line of management) may increase the risk of infectious disease for both the mother and the child, while on the other, inducing labour (active line of management) results in preterm birth with an increase in neonatal morbidity and a potential rise in the number of instrumental deliveries.

The current study aimed to assess the foetal and maternal outcomes associated with PPROM, as well as to identify the risk factors that contribute to PPROM.

Aims and objectives

To assess the fetal and maternal outcome of preterm prelabour rupture of membranes. To identify the risk factors of preterm prelabour rupture of membranes.

METHODS

Case definition

Prelabour rupture of membrane (PROM) is defined as spontaneous rupture of the membranes any time after the 28th week of pregnancy but before the onset of labour. When rupture of the membrane occurs beyond the 37th week but before the onset of labour, it is known as term PROM and when it occurs before 37th completed weeks, it is called preterm PROM (PPROM).

Study setting

This cross-sectional study was conducted in the department of obstetrics and gynecology, Fakhruddin Ali Ahmed Medical College and Hospital, Barpeta, Assam.

Study design

It was a hospital-based prospective observational study design was used.

Study duration

The study was conducted for 12 months from September 2021 to August 2022.

Inclusion criteria

Both primi and multi-gravida women giving consent. Pregnancy duration between 28-36 completed weeks. History of leaking or presence of leaking per vaginum spontaneously. All neonates born to the women in this study.

Exclusion criteria

Established labour at the time of admission. Antepartum hemorrhage (APH). Twin pregnancies and other multifetal gestations; cord prolapse. Patient with diabetes, hypertension and other medical morbidities. Women who refuse to participate in the study.

Sample size

The sample size was calculated using the formula by Charan and Biswas (2013). Based on a prevalence of 5%, a confidence level of 96%, and a margin of error of 5%, the sample size was calculated to be 80.

Sampling

Simple random sampling was used to select study participants.

Data collection

A detailed history was taken, including age, parity, booking status, socioeconomic status, LMP, time of onset of draining, amount of fluid lost, its colour, odour, whether associated with pain or bleeding per vagina, and perception of foetal movements, history of previous similar episodes in other pregnancies, and history suggestive of incompetent os. Any history of vaginal infection, urinary tract infection, or fever was documented. A history of any medical disorders was also gathered. Relevant family history was obtained, with special focus paid to the presence of any risk factors for early membrane rupture. Complete obstetric and menstrual histories were taken. A relevant medical history, such as diabetes, sexually transmitted diseases, vaginal discharge, and any previous gynecological surgery, was obtained. Any history of smoking and alcohol consumption was taken. Routine antenatal investigations were done.

Examination

A thorough general and obstetric examination was carried out. Important criteria such as pallor, icterus, cyanosis, and oedema were noted during the general examination. The pulse, blood pressure, respiratory system, cardiovascular system, and central nervous system were all given special attention. A sterile speculum examination was performed and presence of liquor amnii was detected by visualizing the flow of amniotic fluid from the cervical os and or pooling in the posterior vaginal fornix. A cervical swab was collected and sent for gram stain and culture sensitivity testing.

Statistical analysis

Data from the case record proforma was entered into Microsoft Excel spreadsheet version 2021 and analyzed using IBM-SPSS version 26. The Normality of the data was determined using Kolmogorov-Smirnov test. Categorical data was expressed as frequency and proportion (percentages). Numerical data was represented with mean and standard deviation for parametric data, or median and IQR in a case on non-parametric data.

RESULTS

This hospital-based prospective study to assess the fetomaternal outcome of preterm prelabour rupture of membranes (PPROM) was carried out in the department of obstetrics and gynecology, Fakhruddin Ali Medical College and Hospital, Barpeta, Assam from September 2021 to August 2022 among 80 women with PPROM.

Table 1: Demographic variables.

Variables		Frequency	Percent
Age (in years)	<20	21	26.25
	20-25	35	43.75
	25-30	17	21.25
	>30	7	18.75
Religion	Christian	3	3.75
	Hindu	45	56.25
	Muslim	32	40.00
Education	High school	11	13.80
	Graduate	8	10.00
	Higher secondary	24	30.00
	Illiterate	15	18.80
	Primary school	22	27.50
Occupation	Employed	26	32.50
	Unemployed	54	67.50
Socioeconomic status	Lower	39	48.80
	Lower middle	24	30.00
	Upper lower	13	16.30
	Upper middle	4	5.00
Booked status	Booked	9	11.30
	Unbooked	71	88.80

The majority of respondents belonged to the age group of 20-25 years. The mean age distribution was 21. The majority of the respondents were Hindu (56.25%), while 40.00% were belonging to the Muslim community and only 3.75% were from the Christian community. Among the study participants, the majority (30%) received education up to higher secondary; while 15% of the participants were illiterate. The majority of the study participants (67.50%) were unemployed.

In the present study, the majority of cases belong to the lower socioeconomic class with a total of 39 cases (48.80%), while 24 cases (30.0%) belong to the lower middle class, 13 cases (16.30%) belong to the upper lower class and 4 cases (5.00%) belong to the upper middle class. Among the 80 cases studied, 71 (88.80%) were unbooked cases and 9 (11.30%) were booked cases

Table 2: Maternal clinical characteristics.

		Frequency	Percent
Parity	Multi	33	41.25
	Primi	47	58.75
Gestational age	28-31 weeks	12	15.00
	32 -34 weeks	27	33.75
	35- 36 weeks	41	51.25
Duration of draining per vagina at the time of admission	<6 hours	46	57.50
	>6 hours	34	42.50
Risk factors	UTI	14	17.50
	H/O PROM	8	10.00
	Lower genital tract infections	8	10.00
	Polyhydramnios	4	5.00
	Idiopathic	46	57.50
Cervical swab	Sterile	73	91.25
	Group B *Streptococcus*	4	5.00
	Escherichia coli	2	2.50
	Staphylococcus aureus	1	1.25
Urine culture	*Escherichia coli*	6	7.50
	GBS	3	3.75
	Candida albicans	4	5.00
	Sterile	67	83.75
Steroids administration	No	15	18.80
	Yes	65	81.30
PPROM to delivery interval (category)	<24 hours	45	56.30
	>24 hours	35	43.80

Table 3: Maternal clinical outcomes.

		Freqcy	Percentage
Mode of delivery	Instrumental	6	7.50
	LSCS	27	33.80
	Vaginal	47	58.80
Onset of labour	Induced	23	28.70
	Spontaneous	57	71.30
Induction method	Misoprostol	10	12.50
	PGE2 Gel	13	16.25
LSCS indications	Fetal distress	7	8.80
	Oligohydramnios	6	7.50
	Previous LSCS	5	6.30
	Breech presentation	5	6.30
	Induction failure	4	5.00
Maternal outcome	Chorioamnionitis	6	7.50
	Wound infection	3	3.75
	Puerperal sepsis	5	6.25
	Uneventful	66	82.50
APGAR score	Severely depressed (0 to 3)	5	6.25
	Moderately depressed (4 to 6)	16	20.00
	Excellent (7 to 10)	59	73.75

In the study, 47 (58.75%) participants were first-time mothers (primi gravida), while 33 (41.25%) were women who had given birth previously (multi gravida). The occurrence of premature rupture of membranes (PPROM) was most frequent in women between 35-36 weeks of gestation, with 41 patients (51.25%) affected, followed by 27 patients (33.75%) between 32-34 weeks and 12 patients (15.00%) between 28-31 weeks. This indicates

that 48.75% experienced early PPROM, while 51.25% experienced late PPROM.

Of the 80 cases studied, 46 (57.50%) presented to the medical facility within 6 hours of experiencing vaginal discharge. Approximately 57.50% of the study population had no identifiable risk factors. The most common risk factor observed was urinary tract infection (UTI) in 17.50% of cases, followed by a history of previous PPROM (10%), lower genital tract infection (10%), and polyhydramnios (5.0%).

Culture and sensitivity reports from cervical swabs showed no growth in 91% of cases. Group B *Streptococcus* (GBS) was the most commonly found organism in cultures, detected in 5% of PPROM cases, followed by *Escherichia coli* (2.5%) and *Staphylococcus aureus* (1.25%). *Escherichia coli* was the most prevalent organism isolated from urine cultures, found in 7.50% of cases, followed by *Candida albicans* (5%) and GBS (3.75%).

In the study, 65 cases (81.30%) received antenatal steroid doses. The majority of deliveries (56.30%) occurred within 24 hours of admission to the medical facility.

In the current study, 80 cases were analyzed, of which only 27 cases (33.80%) were delivered through a lower segment caesarean section, while 47 cases (58.80%) were delivered through normal vaginal delivery and 6 cases (7.50%) were delivered through instrumental delivery. Spontaneous onset of labor was observed in 57 cases (71.30%), while labor was induced in 23 cases (28.70%). Among the 47 patients who had a vaginal delivery, 24 had a spontaneous delivery, misoprostol induction was given to 10 patients (12.5%), and dinoprostone gel induction was given to 13 (16.25%) cases.

The most common reason for a lower segment cesarean section was fetal distress (8.8%), followed by oligohydramnios (7.50%). Other indications for a lower segment cesarean section were breech presentation (6.30%), previous lower segment cesarean section (6.30%), and induction failure (5.0%).

In this study, 66 cases (82.50%) of preterm premature rupture of membranes (PPROM) did not result in any maternal complications. However, in 6 cases (7.50%), chorioamnionitis was the most common maternal complication observed, followed by puerperal sepsis (6.25%), and wound infection (3.75%).

APGAR score was excellent (7 to 10) in 73.75% of the cases. Among 80 cases in this study, 62 patients (77.5%) delivered babies whose birth weight were between 2-2.5 kg. 12 patients (15.00%) delivered babies whose birth were between 1.5-2 kg, whereas 3 patients (3.75%) in each group delivered babies whose birth weights were <1.5 kg and >2.5 kg.

Table 4: Fetal clinical outcomes.

		Frequency	Percentage
APGAR score	Severely depressed (0 to 3)	5	6.25
	Moderately depressed (4 to 6)	16	20.00
	Excellent (7 to 10)	59	73.75
Birth weight category (kg)	<1.5	3	3.75
	1.5-2	12	15.00
	2-2.5	62	77.50
	>2.5	3	3.75
Fetal complications	RDS	9	11.25
	Septicemia	6	7.50
	Jaundice	4	5.00
	IVH	2	2.50
	Neonatal mortality	7	8.75
NICU	No	52	65.00
	Yes	28	35.00
Gestational age (weeks)	28-30	4	5.00
	30-34	2	2.50
	35-36	1	1.25

Among 80 cases in this study, 62 patients (77.5%) delivered babies whose birth weight were between 2-2.5 kg. 12 patients (15.00%) delivered babies whose birth were between 1.5-2 kg, whereas 3 patients (3.75%) in each group delivered babies whose birth weights were <1.5 kg and >2.5 kg.

In our study, around 65% of the newborn had no complications. 11.25% suffered from respiratory distress syndrome, 7.50% developed septicemia, 5.00% suffered from jaundice and 2.50% had an intraventricular hemorrhage and 8.75% neonatal mortality was observed.

Out of the study population, 28 (35%) babies were admitted to NICU, out of which 7 neonatal mortality was observed.

In the present study, 7 neonatal deaths were observed, of which 6 were early preterm babies.

DISCUSSION

Premature rupture of membranes is a common pregnancy complication that causes a variety of maternal and neonatal complications, and it is still a topic of interest among obstetricians around the world.

The current study was conducted to identify the risk factors that cause PPROM as well as the fetomaternal complications associated with PPROM.

During the study period, there were 10,537 deliveries. During this time, 688 women were diagnosed with PPROM. So, the prevalence of PPROM was approximately 6.52%. According to a study conducted by Rana et al, the prevalence of PPROM was 8.9%.[10] Regular antenatal check-ups, improved living conditions, and widespread antibiotic use have all contributed to the low incidence of PPROM.

The current study included 80 patients with PPROM who had been admitted. In this study, PPROM was found in 35 cases (43.75%) of the 20-25 years old age group. Similar findings were found in a study conducted by Akter et al (40.33%).[11]

Patients from the lower and lower middle socioeconomic classes were found to be the most likely to be admitted with PPROM (78%), which is comparable to the 61% found in a Pandey et al study.[12]

A link between low socioeconomic status and amniotic membrane defects has been discovered in several studies. Poor hygiene, malnutrition, anaemia, stress, overexertion, high parity, recurrent genitourinary infections, and other factors all contribute to PPROM in low-income people. As a result of these factors, the antibacterial activity in the patient's amniotic fluid decreases, resulting in PPROM. Malnutrition, in turn, raises the risk of infections, which leads to PPROM. As a result, PPROM is caused by a vicious cycle of malnutrition and infections.

The percentage of booked cases in the current study was 11%, while the percentage of unbooked cases was 88%. These findings are comparable to a study conducted by Mohokar et al, who discovered a strong correlation between unbooked cases (84%) and the incidence of PPROM; in contrast to a study conducted by Patil et al, who discovered that unbooked cases accounted for 31% of all cases and booked cases accounted for 69% of all cases.[13,14]

In unbooked cases, antenatal care is inadequate, increasing the mother's risk of infection, which is a major risk factor for PPROM.

The current study found that 58.75% of patients admitted with PPROM were primigravida. Tavassoli et al obtained similar results in her research (multigravida 44.1% and primigravida 55.9 %).[15]

The incidence of preterm premature membrane rupture increased from 15.0% in 28-31 weeks to 33% in 32-34 weeks in our study. This increased to 51% in 35-36 weeks. According to Patil et al, the percentage of PPROM in 28-31 weeks was 7%, 18% in 32-34 weeks, and 75% in 35-36 weeks of gestational age, which is consistent with the current study.[14]

The current study found that 43.5% of mothers had early PPROM and 51% had late PPROM, implying that the risk of PPROM increases with gestational age. This is supported by the fact that PPROM occurs as a result of mechanical stretching of membranes as gestational age increases.

There were no risk factors for PPROM in 57.5% of the study population, with UTI being the most common (17.5%). The second most common risk factors in the current study were a history of PPROM and lower genital tract infection (10% each), followed by polyhydramnios (5.0%). In their study, Gunn et al, discovered that the most common risk factor was breech presentation.[16]

All patients were tested for amniotic fluid culture sensitivity, and 93% of them showed no growth in cultures. The most common organism was discovered to be group B *Streptococcus*, accounting for 5.0% of the positive cases. *S. aureus* (2.5%) and *Staphylococcus aureus* were also isolated (1.25%). *Gardnerella vaginalis* was the most common organism in a study conducted by Triniti et al (34.8%).[17] Similar to our study, group B *Streptococcus* (GBS) was found in 6.8% of cases.

In the current study, 56.30% of the population delivered within 24 hours, which was similar to the findings of Patil et al, (64%) and Russels (80%).[14,18] In our study, 46.30% had a latent phase of more than 24 hours, which correlated with the previous studies.

The vast majority of cases (58.80%) were delivered vaginally, with only 33% delivered via caesarean section. Similar findings were found in a study conducted by Noor et al, where vaginal delivery was found to be 65.86% of the time.[19] 51.3% of the 58.8% of patients who delivered vaginally had a normal vaginal delivery, and 7.5% had an instrumental delivery. In the aforementioned study, instrumental delivery was 20%.

In our study, 71.30% of women gave birth naturally, while the remaining 28.7% were induced. Misoprostol was used to induce 12.5% of the patients, while dinoprostone gel was used to induce 16.5%.

Fetal distress was found to be the most common reason for LSCS in the current study, accounting for 8.8% of cases, followed by severe oligohydramnios (7.5%), previous LSCS (6.30%), breech presentation (6.3%), and induction failure (6.3%) (5%). In the study conducted by Noor et al, the most common indication of LSCS was foetal distress.[19]

Only 17.5% of cases had maternal complications, with chorioamnionitis being the most common (7.5%). My study population had 6.25 % puerperal sepsis and 3.75% wound infection. According to Artal et al study, the incidence of puerperal pyrexia was 13% and that of chorioamnionitis was 3%.[20]

The current study found that 81.25% of PPROM patients had children weighing more than 2 kg, with 77% having a birth weight of 2-2.5 kg.

Only 3.75% of babies were born with a very low birth weight, and 15% were born with a low birth weight. These findings were nearly identical to those of Mohokar et al, who discovered that 26% of women gave birth to babies weighing 2-2.5 kg.[13]

In the present study, 35.0% of PPROM babies were admitted to the NICU due to various complications. These findings were comparable to those of Patil et al, who discovered that 36% of babies in their study were admitted to the NICU.[15]

Respiratory distress syndrome (11.25%) was the most common cause of neonatal morbidity among babies admitted to the NICU, followed by septicemia (7.5%), jaundice (4%), and IVH (2.5%). Similar findings were observed in a retrospective study by Gezer et al where common causes of neonatal morbidity were respiratory distress syndrome (RDS), sepsis, and intraventricular haemorrhage (IVH).[21]

In our study, there were 7 (8.75%) neonatal deaths out of 80 cases. Mohokar et al found similar results in her study, where she discovered 15% neonatal mortality.[13]

In the current study, early preterm babies accounted for 7.5% of neonatal deaths, while late preterm babies accounted for only 1.25%.

CONCLUSION

PPROM is a common pregnancy problem; however, its repercussions can be avoided by utilizing antibiotics, corticosteroids, and other drugs. Although the majority of the patients did not have any risk factors, urinary tract infections can be treated with antibiotics that minimize PPROM. Mothers who have polyhydramnios or multiple gestations are more prone to develop PPROM; consequently, enough rest and care should be provided to such high-risk individuals. Antibiotics used during the latent phase can help minimize maternal problems including chorioamnionitis and puerperal pyrexia. Antibiotics can also be used to prevent neonatal septicemia.

The use of corticosteroids before the first 34 weeks of pregnancy lowers neonatal morbidity, especially respiratory distress syndrome, which is the main cause of neonatal death. Improved newborn care facilities can help to reduce neonatal fatalities by better managing neonatal emergencies.

In the absence of indications of infection, conservative therapy should be utilized to prolong gestation. There is currently no information on the hazards and advantages of carrying a pregnancy past 34 weeks. Because preterm prelabour membrane rupture has a major impact on perinatal outcome, risk-scoring systems including demographic characteristics as well as a history of preterm deliveries should be developed to detect high-risk cases and treat them before membrane rupture.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee FAAMCH, Barpeta

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Cite this article as: Thapa A, Medhi R. Fetal and maternal outcomes and risk factors associated with preterm prelabour rupture of membrane. Int J Res Med Sci 2023;11:2090-7.