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Original Research Article

Impact of premature rupture of membranes and preterm premature rupture of membrane on maternal and neonatal outcomes

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ABSTRACT

Background: Premature rupture of membrane (PROM) and preterm premature rupture of membrane (PPROM) has significant adverse events in the prenatal, peripartum, and neonatal period. The objective of the present study is to understand the risk factors of PROM and PPROM and delivery outcomes in these subjects along with subgroup analysis on comparison of latent period less than 24 hours (group-1) and more than 24 hours (group-2).
Methods: The present data was retrospectively analysed in a private multispeciality birthing centre at Chennai which included a total of 61 cases of PROM and PPROM over a period of six months (January 2022–June 2022).
Results: Among 54% (n=33) of the study participants (n=61) were ranging from 30–35 years. Among n=49 PROM cases and n=12 PPROM, n=25 (51%) (including 8 vacuum assisted) and n=6 (50%) mothers had normal vaginal delivery respectively. Also, among study participants, n=13 (21%) subjects were in latent period more than 24 hours and n=49 (80%) subjects were in latent period of less than 24 hours. The maternal complications in both subgroups showed n=1 case of atonic postpartum hemorrhage (PPH) and puerperal pyrexia. Among the neonates, there were 2 incidences of hypoglycemia in both subgroups of LP. Two cases of sepsis in LP <24 hours and in LP >24 hours respectively. Among the 4 neonates with respiratory distress, 3 neonates were shifted to higher centre and were effectively managed.
Conclusion: Early diagnosis and prompt management of PROM and PPROM can reduce the risk of maternal and neonatal mortality.

Keywords: PROM, PPROM, Maternal outcomes, Neonatal outcomes, Latent period

INTRODUCTION

The rupture of membranes (amniotic sac) before the onset of labor and beyond the viable age is termed as premature rupture of membrane (PROM). Being the most common problem in obstetrics, it complicates approximately 5–10% of term pregnancies. When PROM occurs before 37 completed weeks of gestation it is termed as preterm premature rupture of membranes (PPROM).[1] PPROM is defined as the membrane rupture before the onset of labor that occurs before 37 weeks of gestation.[2] PPROM is a serious pregnancy complication responsible for 28% of neonatal morbidities worldwide, which causes one third of preterm birth and increases the risk of maternal and neonatal morbidities.[3] Currently, the optimal delivery time for PPROM patients is still unclear, and previous studies conducted to analyze the pregnancy outcome showed inconsistent results. Studies have shown that defects in the amniotic membranes occur due to low socio-economic status associated with factors like malnutrition, over exertion, poor hygiene, stress, high parity, recurrent genitourinary infection and anemia.[4]

Maternal complications associated with PROM/PPROM are chorioamnionitis, endomyometritis, placental abruption, dysfunctional labour, increased caesarean rate, post operative wound infection, pelvic abscess, septicaemia and postpartum haemorrhage. The maternal

morbidity has been reported due to respiratory distress syndrome, hypothermia, hypoglycaemia, necrotising enterocolitis, periventricular leucomalacia, intraventricular haemorrhage, bronchopulmonary dysplasia, meconium aspiration syndrome, neonatal sepsis, umbilical cord prolapses.

Three common causes for fetal death associated with PROM/PPROM are sepsis, asphyxia and pulmonary hyperplasia. Early onset neonatal infection (EONI) is often acquired prenatally in pregnancies with PROM and is associated with increased neonatal morbidity and mortality.

The latent period is the time interval between rupture of membranes and onset of labor. In majority of PROM cases approaching term, labor starts within 24 hours (85-90%), but in 10-15% cases, labor may be delayed.[5] When membranes remain ruptured for more than 24 hours (prolonged rupture of membranes) fetomaternal complications are substantial.

Latent period is inversely proportional to the gestational age and directly proportional to the incidence of infection. The objectives of the present study were to study the risk factors contributing to PROM and PPROM, labour outcomes and maternal and neonatal morbidity and mortality associated with PROM and PPROM and also to analyse the subgroups of latent period less than 24 hours and more than 24 hours and its outcomes.

METHODS

This retrospective data analysis of pregnant women with PROM and PPROM was conducted at a private multispeciality hospital at Chennai – Bloom Life Hospital, Velachery. The study included 61 women over a period of six months (January 2022 to June 2022). The maternal risk factors, morbidities, labour outcomes and fetal morbidity and mortality including appearance, pulse, grimace, activity, and respiration (APGAR), birth weight, respiratory distress, need for antibiotics and hospitalization were extracted from hospital records with due consent. The data was entered in Microsoft excel, coded and analysed descriptively wherever applicable.

The maternal and fetal conditions were closely monitored until delivery by a team of obstetrics and gynecology department. Maternal vital signs were monitored every 8 hours. Continuous fetal heart rate monitoring and ultrasound were performed to evaluate the status of the fetus.

Any abnormal fetal maternal complications were indicators for delivery. Mode of delivery depended on maternal and fetal conditions and associated complications. A team of pediatricians were also involved in the rescue of newborns in advance. Newborns were admitted to neonatal intensive care unit (NICU) according to their conditions.

Ethical consideration

All biomedical ethics were followed and written permission was obtained from the hospital managers and the hospital records were confidentially analysed retrospectively. Informed consent was obtained from all the study participants.

RESULTS

About 54% (n=33) of PROM/PPROM subjects were between 30-35 years (Table 1).

Table 1: Distribution of age among PROM and PPROM subjects.

Age group (years)	Number of subjects
<25	3
25-30	22
30-35	33
>35	3
Total (N)	61

The mean age group for both PROM and PPROM groups was 30 years. There were 27 primiparous and 22 multiparous women in PROM group and 8 primiparous and 4 multiparous women in PPROM group (Table 2).

Table 2: Distribution of age, gestational age and gravida of PROM and PPROM subjects.

Characteristics	PROM	PPROM
Mean age	30.46	29.69
Gestational age (weeks)	37.88	34.66
Gravida		
Primi	27	8
Multi	22	4
Total (N)	49	12

The study results from Table 2 revealed the incidence of PPH due to atonicity was 3% (n=2) (Table 3).

Table 3: Distribution of maternal morbidity among PROM and PPROM subjects.

Maternal morbidity	Numbers	Percentage
Postpartum hemorrhage (atonic)	2	3
Postpartum hemorrhage (traumatic)	0	0
Manual removal of placenta	1	1
Puerperal pyrexia	0	0
Wound sepsis	0	0
Maternal mortality	0	0

In the present study the risk factors of the study subjects presented with PROM and PPROM (n=61) were high

incidences of previous abortions (n=46) (75%) followed by gestational diabetes (n=12) (19%), Previous LSCS (n=11) (18%), oligohydramniosis (n=5) (8%) cord around the neck (n=2) (3%) (Figure 1). Nearly 34% were induced by PGE 1, 33% using PGE 2 and 33% miso and 44% had spontaneous delivery (Figure 2).

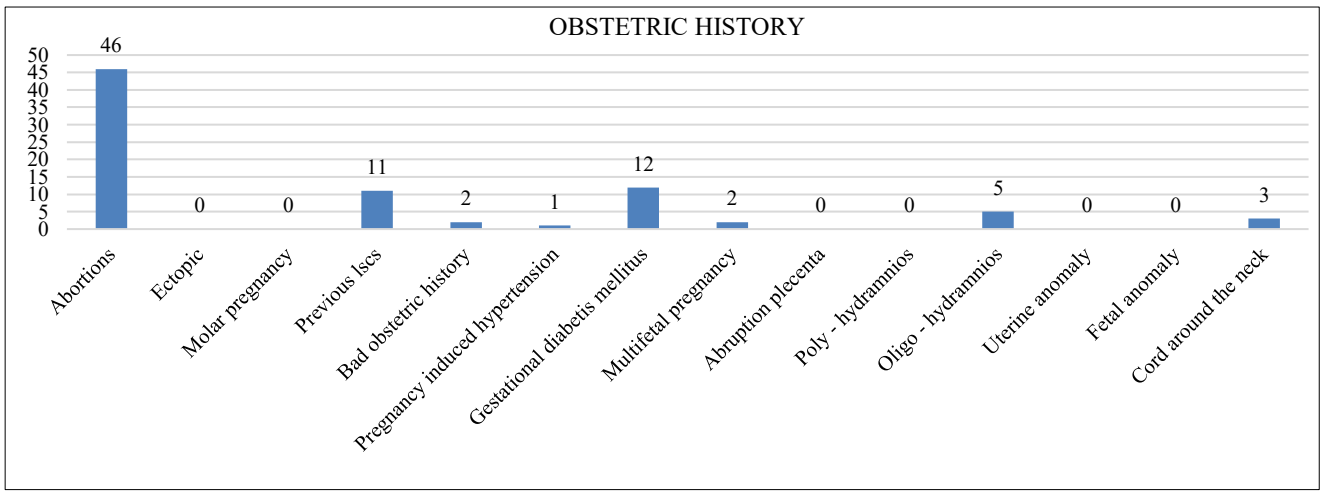

Figure 1: Assessment of risk factors of PROM and PPROM.

Among the total PROM and PPROM subjects (n=61), n=40 cases went into spontaneous labour among which n=26 needed augmentation. 21 subjects were induced using Miso /PGE1/PGE2 (Table 4).

Among n=49 PROM cases there were 25 vaginal deliveries (including 8 vacuum deliveries) and 6 vaginal deliveries (including 1 vacuum delivery) in n=12 PPROM cases respectively (Table 5).

About 77.5% (n=38) of subjects with PROM had LP< than 24 hours and 75% (n=9) of subjects with PPROM subjects had LP< than 24 hours. About 22.44% (n=11) of PROM subjects 25% (n=3) of PPROM subjects had LP> than 24 hours respectively (Table 6). There were 2 incidences of hypoglycemia in both subgroups of LP. Two cases of sepsis in LP<24 hours and 1in LP>24 hours respectively. Among the 4 cases of neonates who had respiratory distress, 3 neonates were shifted to higher centre and were effectively managed (Table 7). Our present study had 26 vaginal deliveries (54%) in subjects with LP<24 hour (n=48) and 6 vaginal deliveries (46%) in subjects with LP>24 hours (n=13) respectively (Table 8).

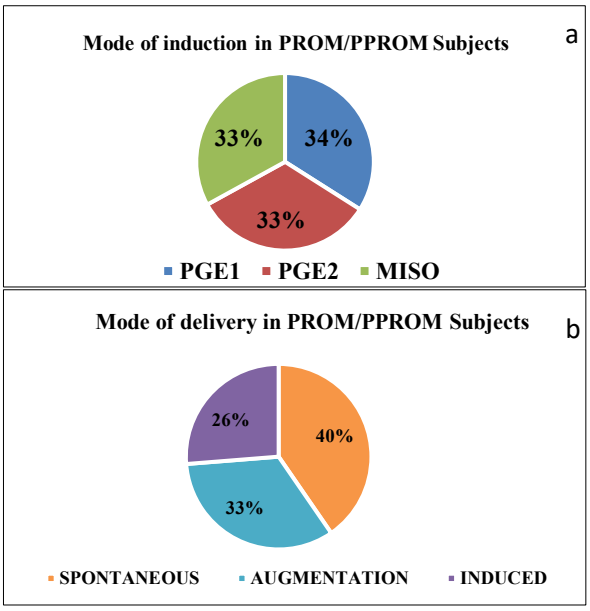

Figure 2 (a and b): Mode of induction in PROM/PPROM subjects.

Table 4: Impact of gestational week on spontaneous and induced labour.

S. no.	Gestational week	Spontaneous labor	Induced labor
1	29-30	1	0
2	33-34	2	2
3	35-36	4	3
4	37-38	16	15
5	39-40	13	5
Total		40	21

Table 5: Overall delivery outcomes in PROM and PPROM.

Induction outcomes	PROM (n=49)	PPROM (n=12)	Total
Comparison of mode of delivery			
Vaginal delivery	25	6	31
Vacuum delivery	8	1	
Forceps delivery	0	0	
LSCS			30
Elective LSCS	2	1	
Emergency LSCS	22	5	

Table 6: Distribution of latent period among PROM and PPROM subjects.

Latent period (hours)	PROM (>37 weeks) (n=49)		PPROM (<37 weeks) (n=12)	
	F	Percentage (%)	F	Percentage (%)
Subjects with LP< than 24	38	77.55	9	75
Subjects with LP> than 24	11	22.44	3	25

Table 7: Distribution of maternal and neonatal complications according to latent period (<24 hours and >24 hours).

Morbidity/mortality	LP<24 hours (n=49)	LP>24 hours (n=12)
Postpartum hemorrhage (atonic)	1	1
Postpartum hemorrhage (traumatic)	0	0
Puerperal pyrexia	1	1
Wound sepsis	0	0
Maternal mortality	0	0
Hypoglycemia	2	2
Sepsis	2	1
Hypothermia	0	0
Convulsion	0	0
Infections	1	2
Antibiotic therapy	11	9
Respiratory distress	2	2
Shifted to higher centre	2	1
Fetal mortality	0	0

Table 8: Mode of delivery and latent period.

S. no.	Mode of delivery	LP<24 hours (n=48)		LP>24 hours (n=13)	
		F	Percentage (%)	F	Percentage (%)
1	Vaginal delivery	26	54	6	38
2	Vacuum delivery	8	16	1	7.6
3	Elective LSCS	2	4	1	7.6
4	Emergency LSCS	20	46	6	46.15

DISCUSSION

Distribution of PROM and PPROM shows that among n=61 subjects, n=49 were cases who approached with PROM and n=12 were cases who approached with PPROM. The present study reports that most women (n=33) with PROM and PPROM were between 30-35 age groups followed by 25-30 age group (n=22) (Table 1 and Table 2). Previously many studies have also suggested that mothers at age 30 years and above are at more risk for PROM and PPROM.[6] The study results from Table 3 revealed the incidence of PPH due to atonicity was 3% (n=2). The higher incidence of PPH in PROM cases have been reported in previous published studies due to increased instrumental vaginal delivery, atonic uterus, prolonged labour and rarely due to coagulation failure PPH is significantly more common among PROM cases and often severe enough requiring blood transfusion. The optimal time for delivery depends on a continuous evaluation of gestational age, maternal and fetal complications, and even the medical service quality level. Previous studies have shown mixed results on the expected treatment results.[7]

In the present study (Figure 1) the risk factors of the study subjects presented with PROM and PPROM (n=61) were high incidences of previous abortions (n=46) followed by gestational diabetes (n=12), previous LSCS (n=11), oligohydramniosis (n=5), cord around the neck (n=2). According to a previous study on assessing risk factors for PROM, women who were hypertensive during pregnancy were estimated to be 2.8 times more likely to have PROM than normotensive women. Similarly, women who had a history of abortion were 3.7 times more likely to have premature rupture of membrane compared to women who did not experience abortion. Likewise, women who had a history of caesarean section in their last pregnancy were, 3.4 times more likely to have premature rupture of the membrane when compared to women who did not have a history of caesarean section in the preceding pregnancy. The above facts have been found to be convincing with our present study with relevancy.[8]

The present study also reveals that women with gestational diabetes mellitus (GDM) (n=12) has been associated with PROM. Another study by Stancu et al reported that gestational diabetes mellitus (GDM) accounted for the sole pregnancy-associated pathology.[9] According to literature, the high levels of 'sugar' entering the fetus through the placenta promoted hyperglycemia and hyperosmolar diuresis, which led to increased urinary excretion, excess maternal amniotic fluid, and the incidence of PROM and premature birth.

Among the total PROM and PPROM subjects (n=61), n=40 cases went into spontaneous labour among which n=26 needed augmentation. 21 subjects were induced using Miso /PGE1/PGE2. Among spontaneous labour cases nearly 40% (n=16) of them were between 37-38 weeks of gestation and among induced labour cases nearly 71% (n=15) were between 37-38 weeks of gestation (Figures 2 and 4).

The delivery outcomes of PROM and PPROM subjects resulted in 25 vaginal deliveries (including 8 vacuum deliveries) and 6 vaginal deliveries (including 1 vacuum delivery) as shown in Table 5 respectively and the main cause of LSCS in the present study was non progression of labour (n=13) followed by fetal distress (n=3). In the present study, subjects with LP less than 24 hours and more than 24 hours were analysed among PROM (n=49) and PPROM (n=12) cases as shown in the Table 6. And the maternal and neonatal complications of morbidity and mortality have been evaluated.

The two major contributors of preterm birth are preterm labour and rupture of the membranes. Study indicates that n=48 babies of PROM parturient had very good APGAR score at 5 minutes and n=9 babies of PPROM cases had an APGAR score between 7-8 at 5 minutes. The study results indicate birth asphyxia in only 2 neonates (APGAR<7) in mothers of PPROM group (Table 6).

In order to have successful newborn outcomes, the latent period (LP) between the rupture of the membranes and delivery is crucial. Though predicting the latency period is still a challenge in obstetric practise, studies have established that women with cervical lengths less than/equal to 2.5 cm have a decreased latency period in comparison to females with cervical lengths more than 2.5 cm.[11] The above table (Tables 6 and 7) indicates that the maternal complications in both groups with LP<24 hours group and in 2 neonates with LP>24 hours. Women who have had previous preterm deliveries should be advised that short interpregnancy intervals, particularly those less than six months, may lead to unfavourable pregnancy outcomes.

Out of 62 live neonates (including a twin baby), n=22 neonates (PROM=11, PPROM=11) required antibiotic therapy among which n=2 neonates in LP<24 hours group and in 1 neonate with LP>24 hours group has incidence of sepsis. Antibiotics have become the mainstay of therapy for patients with pre-labour membrane rupture.[12] Studies have shown that bacterial contamination of amniotic fluid can occur because of amniocentesis. Life-threatening complications like neonatal intraventricular bleeding, white brain matter injury, bronchopulmonary dysplasia (BPD), necrotizing enterocolitis (NEC), and sepsis can occur as a consequence of chorioamnionitis; hence the role of antibiotics is prime importance for premature rupture of membranes and preterm labor and effect on fetal outcome.[13-15]

Though the present study has 12 women with gestational diabetes mellitus (GDM), the incidence of hypoglycemia occurred in 2 neonates with LP<24 hours and in 2 neonates with LP>24 hours respectively. Among the 4 cases of neonates who has respiratory distress, 3 neonates were shifted to higher centre and were effectively managed. There was no mortality reported (Table 9). Studies also report higher rates of instrumental vaginal deliveries and caesarean section in PROM and PPROM cases. Our present study had 26 vaginal deliveries (54%) in subjects with LP<24 hour (n=48) and 6 vaginal deliveries (46%) in subjects with LP>24 hours (n=13) respectively. But both the groups had an unequal sample size and therefore the study results are inconsistent (Table 8).

While studies confirm that prolonged latent phase as an indicator of augmentation with oxytocin, increased instrumental and caesarean deliveries and increased morbidity. It is noteworthy to note that there was more multipara in this study and inefficient uterine contraction is common among primy than multipara. However, the higher percentage of vaginal deliveries, neonatal wellbeing with no mortality in this present study could have been possible due to good team effort of obstetricians, natural birth consultants and pediatricians who provide holistic birth approach for a successful vaginal delivery.

Upon analysing the parity and the labour outcomes of PROM and PPROM subjects, it was found that the parity has no association with labour outcomes in PROM and PPROM cases. Low socioeconomic status, genital tract infection leading to choriodecidual inflammation, urinary tract infection (UTI), second or third trimester vaginal bleeding, uterine distension (e.g., polyhydramnios, multi fetal pregnancy), cervical conization or cerclage, exposure to air pollution, decrease in the collagen content of the membranes. Micronutrient deficiencies that affect collagen formation have been shown to alter collagen structure and have been associated with an increased risk of preterm PROM. Hence pregnant women should be emphasized to continue to take supplementation during pregnancy and lactation.[6]

CONCLUSION

PROM and PPROM remains as a challenging situation to be faced by obstetricians and an important cause for maternal and fetal morbidity with increased rate of caesarean section delivery. While previous studies indicate that in majority of cases, PROM and PPROM may increase the risk of LSCS and maternal and fetal morbidity, the present study results indicate well equipped team of obstetricians with training on high-risk pregnancy can face the challenge of prolonged latent period provided and the maternal and neonatal risk factors can be effectively managed. The study also emphasizes that early diagnosis and prompt management of term PROM, is highly essential to educate the antenatal mother regarding regular and timely antenatal check-up for the better maternal and fetal outcome. Our findings supplemented the limited evidence of prolonged latent period more than 24 hours. However, the study has limitation of poor sample size and sampling technique since it is a retrospective analysis which needs to be overcome in the near future with large scale prospective studies.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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