

Maternal and Neonatal Outcome related to delivery time following premature rupture of membranes

Aditi Siddharth, MS OG MRCOG, Registrar Obstetrics and Gynaecology, Oxford University Hospitals, Oxford, United Kingdom

Sharanya Thiagarajan, MS OG, Consultant, Mint Hospitals, Chennai, India

Namrita George, MSOG, Consultant, Aster CMI Hospital, Bangalore, India

Corresponding author: Aditi Siddharth

Abstract

Introduction

Premature rupture of membranes (PROM) is the pre-labour spontaneous rupture of the amniotic membranes (1). Controversy exists on how to manage PROM in term pregnancies. Some go into spontaneous labour with expectant management, avoiding the risks of induction of labour (2, 3). However, this approach could increase the risk of both maternal and neonatal morbidity (4). The purpose was to evaluate the maternal and neonatal outcomes of deliveries following PROM with regards to time elapsed from rupture of membranes to delivery.

Methods

A prospective observational study was conducted in a tertiary hospital in India. Considering time from PROM to delivery, 3 groups were analysed: Group A- less than 12 hours, group B- 12-24 hours, group C- more than 24 hours.

Outcomes included mode of delivery and morbidity like chorioamnionitis, wound infection and neonatal sepsis.

Results

57.6% of 269 were in group A, 30.4% in group B and 11.8% in group C. Group C had the majority of unbooked (21.9%) and required more induction. There was a statistically significant difference in foetal distress between group A and C. 60% in group C had a Caesarean section. There was a significantly higher rate of wound infections in Group C (36.8%). All three groups showed neonatal morbidity of PPRM were significantly higher to the PROM.

Discussion

More unbooked patients in group C with an increased time of presentation to the hospital after PROM, highlighted the importance of regular contact with healthcare professionals during pregnancy. Morbidity increased beyond 24 hours of PROM. There is statistically significant increase of foetal distress, chorioamnionitis and caesarean sections. Women who delivered after 24 hours of PROM had a higher risk of wound infection, endometritis, UTI.

Conclusion

Antenatal counselling about PROM is required. An agreed departmental protocol to deliver by 24 hours of PROM should be implemented.

Keywords: Premature rupture of membranes, chorioamnionitis, neonatal sepsis, prolonged rupture of membranes

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I. Introduction

Premature rupture of membranes (PROM) is the spontaneous rupture of the amniotic membranes, before the onset of labour (1). When PROM occurs before 37 weeks of gestation, this is referred to as preterm premature rupture of membranes (PPROM) (5). PROM has an incidence of 2-18% (6). Controversy exists on how best to manage PROM in the context of term pregnancies. On one hand, with expectant management, women may go into spontaneous labour, thus avoiding the additional risks associated with induction of labour like increased intervention (increased use of epidural, caesarean, and instrumental birth) (2, 3). However, some authors believe this approach could increase the risk of both maternal and neonatal morbidity (4). There is no clear globally accepted protocol to guide clinicians on when to induce women after term PROM. However, with PPRM, there is plenty of evidence, including a Royal College of Obstetricians and Gynaecology (RCOG) guideline, to advice clinical management (7).

In the tertiary unit where this study was conducted, it was noted that women were presenting at variable times after PROM. Also, each unit within the department had a slightly different protocol to when induction was offered to these women. Hence this observational study was designed to consolidate evidence and formulate a standard protocol for the unit.

The purpose of this study was to evaluate the maternal and neonatal outcomes of deliveries following PROM after completion of 34 weeks, with regards to time elapsed from rupture of membranes to delivery.

II. Material and Methods

This was a retrospective observational study of women admitted to large tertiary level teaching hospital in Southern India. Women with rupture of membranes prior to the onset of labour and the neonates born to them were included. The study was conducted from June 2009 to June 2011. Gestational age of less than 34 weeks and more than 40 weeks were excluded as gestational age would be a significant confounding factor for poor neonatal outcome. Evidence existed to support this which showed on the completion of the 34th gestational week, the incidence of respiratory distress syndrome (RDS) sharply reduced with zero mortality(8). Only singleton deliveries were included in this study and any women who received antibiotics prior to admission to hospital (ie. from a primary health care setting or from another hospital) were excluded. Any immunocompromised women including those who were HIV positive, on immunosuppressive medication or with diabetes mellites were excluded.

Initial workup included a detailed history (age, obstetric history, exact time of rupture of membranes, colour of the liquor etc), general work up (pulse rate, blood pressure, temperature etc) and obstetric exam. Whether the patients were booked (ie. received regular antenatal care, with at least one visit in each trimester) or unbooked was noted. A sterile speculum examination was conducted to confirm the rupture of membranes (by visualisation of pooling of fluid) and a high vaginal swab (HVS) was taken. A vaginal examination was conducted to assess the cervix and calculate the modified Bishops score. Blood tests including a full blood count, total leukocyte count, differential count, and C reactive protein (CRP) was performed on admission. All women were given prophylactic intravenous Cefotaxime 1gm every 12 hours (till delivery), which was the protocol within this tertiary hospital for PROM. A 4 hourly vital signs record (temperature, pulse, blood pressure) was maintained. The management of labour was as per protocol, which included induction of labour based on Bishop score (PGE2 gel if the score was ≤ 6 or forewater ARM with oxytocin infusion). For women who received PGE2 gel, a repeat vaginal examination was performed after 6 hours to check if a repeat PGE2 gel was required (as per Bishop score). women were augmented with oxytocin from 4 cms of dilatation if they were contracting less the 4 in every 20 minutes, following the protocol for active management of first stage of labour. All women had an admission cardiotocogram (CTG) and had continuous electronic foetal monitoring (CEFM) in labour. Caesarean sections or instrumental deliveries were performed for obstetric indications. An endometrial swab was taken, and placenta was sent for histopathological examination, if there were signs of chorioamnionitis at caesarean section. Cord gases were recorded at birth if there were signs of foetal distress.

Chorioamnionitis was diagnosed using the following criteria (9)

- Fever >100.4 deg F
- With at least two of the following criteria:
 - o Maternal tachycardia (>100 beats/minute)
 - o Foetal tachycardia (>160 beats/minute)
 - o Uterine tenderness
 - o Foul smelling vaginal discharge
 - o Maternal leucocytosis ($>15,000$ /dL)
 - o CRP >2.7 mg/dL

Postpartum investigations were performed based on symptoms and the clinical picture. Urine culture was sent if there were symptoms of a urinary tract infection (UTI). Wound swab was taken if the caesarean section wound, or episiotomy was infected.

All neonates were initially assessed in the neonatal intensive care unit (NICU). Symptoms and signs of early onset neonatal sepsis (within 72 hours of birth) were looked for. Late onset neonatal sepsis is attributed to nosocomial infections and not related to PROM (10). A sepsis screen was performed (as detailed below). All the neonates observed in this study received prophylactic antibiotics, which were discontinued if the blood culture results were negative.

Neonatal sepsis screen (10)

- Blood culture and sensitivity
- Indirect markers:

- Total Leukocyte count: <5000/cumm or >20,000/cumm
- Band forms
- Toxic granules
- Micro ESR >15mm at the end of the 1st hour
- CRP>1.2 mg/dL
- Platelets <1.5lakhs/cu mm

For analysis, the women were divided into 3 groups based on the time interval between rupture of membranes and delivery

1. Group A- less than 12 hours
2. Group B- 12-24 hours
3. Group C- more than 24 hours

The analysis was focussed on evaluating maternal and neonatal outcome with regard to the time between rupture of membranes and delivery.

The following features were analysed:

1. Gestational age
2. Management of labour (oxytocin or PGE2 induced, oxytocin augmented, spontaneous onset of labour)
3. Foetal distress during labour (CTG assessment or cord pH measurement)
4. Signs of chorioamnionitis
5. Obstetric intervention for delivery (instrumental birth or caesarean section)
6. New-born respiratory depression (APGAR scores at 1 and 5 minutes)
7. Postpartum maternal infections: wound, endometritis, urinary tract infections
8. Neonatal sepsis
9. Neonatal morbidity
10. Neonatal mortality
11. Maternal mortality

The Pearson chi squared test was used to determine statistical significance among the three groups.

As this was an observational study where the treatment protocol of the hospital was not altered in anyway, ethics approval was sought but was determined as not required.

III. Results

A total of 269 women were included in the study. 57.6% (155/269) delivered were in group A (delivered <12 hours of PROM), 30.4% (82/269) were in group B (delivered 12-24 hours of PROM) and 11.8% (32) were in group C (delivered >24 hours of PROM). The mean age and age range were comparable across all three groups (average age 25 years across the three groups). 94.8% in group A and 90.2% of women in group B were booked whilst only 78.1% of women in group C were booked. Parity distribution amongst group A and B were comparable (61.3% and 67.1% primigravida respectively) and group C had a slightly higher number of primigravida at 78.1%.

Management of induction and labour:

In group A, 81.3% went into spontaneous labour whilst in group B and C, it was 48.8% and 40.6% respectively.

90 of the 269 women were induced. None of the women in this study were directly given oxytocin for induction. All the women in group A received PGE2 gel. Whilst the majority of women received PGE2 gel in the other two groups, 4 women were given a combination of PGE1 and PGE2.

More than 50% of the women required augmentation of labour with oxytocin (group A 50.3%, group B 86.6% and group C 59.4%).

Incidence of foetal distress: There was a statistically significant difference in the incidence of foetal distress (p value = 0.026) between group A and C (7.7% vs 15.6% respectively) when foetal distress was diagnosed using CTG interpretation. This significance, however, was not seen when comparing cord gas results (1.9% in group A vs 6.3% in group C with p value of 0.085).

APGAR score: An APGAR score of less than 7 was considered as significantly low for both the 1 and 5 minute score (11). With the 1-minute APGAR score, there was no significant difference among the three groups. With the 5-minute score, only group B had 2 neonates with a score less than 7 (2.4%).

Maternal infection and morbidity

No mothers in group A and B had fever or tachycardia, whereas 9.4% of mothers in group C had fever and 6.3% of mothers in group C had maternal tachycardia. 25% of mothers in group C had leucocytosis as compared to 14.2% in group (statistically significant with p value of 0.011). No other clinical signs of chorioamnionitis was present in any group.

Histological diagnosis of chorioamnionitis was made in 2 cases (one patient each in group B and C). The patient in group B had a baby that was diagnosed with neonatal sepsis and the patient in group C had a caesarean section wound infection (*Acinetobacter* cultured from the wound swab).

Mode of delivery:

Nearly 60% of women in group C had a Caesarean section compared to 34.1% in group B and 37.4% in group A. This was statistically significant (p value 0.009).

High vaginal swab results: there were a significantly higher rate of positive cultures in Group C (9.3%) when compared to group A and group B (1.2%). But none of these patients had significant morbidity- either neonatal or maternal.

Urine culture and endometrial swab results: Group A and Group C had women with a positive urine culture (3.2% vs 6.2%). Whilst none of the mothers or babies in group A suffered any further morbidity, the patient in group C who had *Acinetobacter* in the urine culture had a caesarean section wound infection and endometrial swab culture positive for MRSA. There was no neonatal morbidity associated with this.

Caesarean section wound infection: There was a significantly higher rate of wound infections in Group C (36.8%) when compared to group A (3.4%) and group B (0%) with a p value of 0.005. The organisms cultured included MRSA, *Klebsiella* and *Acinetobacter*. There was no neonatal morbidity associated with any of these patients.

Neonatal outcome: A subgroup analysis for neonatal outcome was performed where neonates between 34-37 weeks (PPROM) were compared to those beyond 37 weeks (PROM) to understand if gestational age played a role in outcomes. In all three groups, the results showed that the neonatal morbidity in the PPRM category were significantly higher to the PROM category (p=0.005). This included elevated CRP, leucocytosis, thrombocytopenia, and positive blood culture. 2 blood culture results were positive in group B, with *Enterococcus faecalis* and *Staphylococcus aureus*.

Umbilical stump infection (*Enterobacter*, MRSA and *Klebsiella*) was noted in one baby in the PPRM subgroup for group C.

There were no cases of maternal or neonatal mortality

IV. Discussion

PROM can lead to increased maternal and neonatal complications, if managed inappropriately. Even though this is known, there is no clarity on timing of birth after PROM, especially after 37 weeks. Since our study was designed to be observational in nature, it captured real world data with no manipulation of how labour was managed in our unit for PROM. Also, women presented at various time intervals from PROM and this information was embedded into the analysis as the analysis considered time from rupture of membranes to delivery.

More than 50% of the babies were delivered within 12 hours and only 11.8% occurred after 24 hours. There was no obvious correlation between maternal age and time of presentation or delivery. There was no significant correlation between parity and PROM duration. This is consistent with evidence found in other studies (8, 12). In keeping with existing evidence, most women who went into spontaneous labour delivered within 12 hours.

An interesting finding was that most of the unbooked patients were in group C, correlating with an increased time between rupture of membrane and presentation to the hospital. This was a statistically significant finding. This helps highlight the importance of regular contact with healthcare professionals during pregnancy as information like when to present to hospital will be reiterated throughout pregnancy. This would have helped this cohort of women present earlier and reduce their risk of morbidity.

The evidence from this study shows that morbidity increases when women labour beyond 24 hours of PROM. There is statistically significant incidence of foetal distress, chorioamnionitis and an increased caesarean section rate. Women who delivered after 24 hours of PROM also had more chances of a wound infection, endometritis, UTI (double the risk when compared to <12-hour group). Further subgroup analysis showed that the PPRM cohort were worse off when compared to their term counterparts in all three groups.

This study highlights the importance of good antenatal care with regular iterative counselling of women to help them present to hospital in a timely manner when they rupture membranes. Also, this study further adds evidence to suggest we should be delivering women within 24 hours of PROM in order to reduce the risk of intervention (i.e., caesarean section) and morbidity. A prescriptive, peer reviewed protocol should be in place for each department that helps with antibiotic administration and starting induction of labour on time. This should be an auditable standard, which should be reviewed annually to check compliance.

V. Conclusion:

PROM and PPRM can add significant maternal and neonatal morbidity if not managed in a timely manner. This study helps add to the evidence pool and reiterates the importance of a standard protocol for management of PROM that is followed consistently in the hospital and is audited on an annual basis to check compliance. This study also highlights the importance of patient education during antenatal care, so they present to the hospital in a timely manner.

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