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Expectant Management of Preterm Prelabor Rupture of Membranes: Outcomes by Gestational Age at Delivery

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Abstract

Background: Preterm prelabor rupture of membranes (PPROM) accounts for one-third of preterm deliveries and is associated with neonatal and maternal mortality.

Objectives: This study aimed to compare outcomes of expectant management in women with PPROM according to gestational age at delivery: 28 to 33^{+6} weeks versus 34 to 36^{+6} weeks.

Methods: In this descriptive-analytical cohort study, 40 pregnant women with PPROM underwent expectant management and were categorized into two groups according to gestational age at delivery: 28 to 33^{+6} weeks and 34 to 33^{+6} weeks (n = 20 per group). Maternal and neonatal outcomes were compared using appropriate statistical tests.

Results: The 28 to 33^{+6}-week group had significantly higher rates of neonatal intensive care unit admission (85% vs. 15%, P < 0.001), respiratory distress syndrome (50% vs. 10%, P = 0.006), and neonatal hypoglycemia (85% vs. 5%, P < 0.001) than the 34 to 33^{+6}-week group. Apgar scores at 1 and 5 minutes were also significantly lower in the earlier gestational-age group (P < 0.001). Conversely, neonatal sepsis was significantly more prevalent in the 34 to 33^{+6}-week group (30% vs. 5%, P = 0.006). No significant differences were observed in maternal complications or mode of delivery.

Conclusions: These findings suggest that expectant management of PPROM until 36 weeks may be feasible and may reduce complications of prematurity under strict monitoring. Larger multicenter trials are needed to confirm these associations.

Keywords: Preterm PROM, Expectant Management, Preterm Birth, Amniotic Fluid Index

1. Background

Global preterm birth rates have shown no measurable change over the past decade. Preterm birth, defined as a live birth before 37 weeks of gestation, accounts for 33.1% of neonatal deaths globally (1). Rates have increased slightly in Southern Asia and sub-Saharan Africa (2). Current management of preterm prelabor rupture of membranes (PPROM) involves either initiating birth soon after membrane rupture or adopting a wait-and-see approach, known as expectant management (3). Expectant management of PPROM may improve neonatal outcomes (4), particularly in low-risk pregnant women (5). For families affected by previable PPROM, active and expectant management are options considered in light of the chances of fetal survival (6). Sklar et al. reported that data on expectant management can help clinicians and prospective parents make shared decisions (7). Increasing evidence indicates that the risk of preterm birth is closely associated with maternal health (8, 9). Given the associated risks of perinatal and maternal mortality, physicians must consider conservative management (10). Preterm prelabor rupture of membranes is characterized by a short latency period, an increased likelihood of umbilical cord compression, and a higher risk of intrauterine infection (11).

Preterm birth rates have increased in many industrialized countries, including Iran. In 2015, Vakilian et

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al. (12) estimated the overall prevalence of preterm birth in Iran at 9.2%, compared with the worldwide rate of 10.6% (13). Few studies have been conducted locally, and many do not accurately represent the national population. Recent studies have highlighted the predictive value of the uterocervical angle for identifying women at risk of preterm birth (14), and evidence supports the use of vaginal progesterone to reduce this risk in selected populations (15). Understanding the local context is therefore essential to efforts to reduce preterm birth and stillbirth, as well as associated neonatal and maternal mortality.

2. Objectives

This single-center study at Imam Reza Hospital in Kermanshah, Iran, aimed to compare maternal and neonatal outcomes following expectant management of PPROM between women who delivered at 28 to 33^{+6} weeks and those who delivered at 34 to 33^{+6} weeks, with the goal of improving outcomes for women and their children.

3. Methods

3.1. Study Design and Setting

This descriptive-analytical observational study included pregnant women with PPROM who were admitted to Imam Reza Hospital, Kermanshah, Iran, between July 1, 2020, and July 31, 2021. The study protocol was approved by the Medical Ethics Review Committee of Kermanshah University of Medical Sciences (approval code: IR.KUMS.MED.REC.1400.84). All participants provided written informed consent before enrollment.

3.2. Participants and Selection Criteria

Pregnant women presenting with clinical signs of PPROM between 28 weeks and 36 weeks plus 6 days of gestation were assessed for eligibility. The inclusion criteria were admission following membrane rupture, absence of active labor during the first 24 hours after admission, and consent to participate. The diagnosis was based on medical history, physical examination, and sterile speculum examination to confirm amniotic fluid pooling. When the clinical assessment was inconclusive, the diagnosis was confirmed using the fern test or AmniSure test.

Exclusion criteria included active labor pain at admission, chorioamnionitis diagnosed at initial presentation, multiple gestation, non-reassuring fetal status, major fetal anomalies, meconium-stained amniotic fluid, or any maternal/fetal contraindications to expectant management.

3.3. Grouping and Clinical Protocol

Participants were categorized according to gestational age (GA) at delivery:

Group 1 (GA1): Delivery between 28 weeks and 33 weeks plus 6 days (28 to 33^{+6} weeks).

Group 2 (GA2): Delivery between 34 weeks and 36 weeks plus 6 days (34 to 33^{+6} weeks).

Gestational age was calculated from the last menstrual period and verified by first-trimester or early second-trimester ultrasonography. Digital cervical examinations were avoided unless active labor was established to minimize the risk of ascending infection.

All participants received standard hospital care for expectant management of PPROM. The antibiotic regimen consisted of intravenous ampicillin and erythromycin for the first 48 hours, followed by oral amoxicillin and erythromycin for another 5 days, completing a 7-day course. Eligible women also received antenatal corticosteroids, consisting of two 12-mg doses of intramuscular betamethasone administered 24 hours apart.

3.4. Maternal and Fetal Monitoring

Fetal well-being was assessed using cardiotocography three times daily. Ultrasonography and biophysical profiles were performed twice weekly to assess amniotic fluid volume and overall fetal status. Maternal inflammatory markers, including white blood cell count, C-reactive protein, and erythrocyte sedimentation rate (ESR), were monitored twice weekly. After delivery, mothers were monitored daily for clinical signs of infection. Neonatal vital signs, including pulse rate, body temperature, blood pressure, and respiratory rate, were recorded every 6 hours.

3.5. Outcome Definitions

Chorioamnionitis was defined as a maternal core temperature of ≥ 38 °C accompanied by uterine tenderness, maternal and/or fetal tachycardia, or foul-smelling amniotic fluid in the absence of another infectious source, with elevated inflammatory markers (C-reactive protein, ESR, and white blood cell count).

Neonatal sepsis/infection was defined as clinical signs of sepsis accompanied by a positive blood, cerebrospinal fluid, or urine culture.

Neonatal hypoglycemia was defined as a blood glucose level < 40 mg/dL at any measurement during hospitalization.

3.6. Statistical Analysis

Statistical analysis was performed using SPSS version 20.0. Quantitative variables were expressed as mean ± standard deviation and compared using the independent-samples t-test for normally distributed data. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test. Fisher's exact test was used when the expected frequency in any cell was less than five. All tests were two-tailed, and $P < 0.05$ was considered statistically significant.

4. Results

4.1. Study Flow and Participant Selection

Participant selection is summarized in Table 1. Of 75 pregnant women initially assessed for eligibility, 35 were excluded: 18 developed active labor or compromised fetal status within 24 hours of admission, 13 developed labor or compromised fetal status during the subsequent latency period, and 4 developed clinical signs of chorioamnionitis during the latency period at < 34 weeks of gestation. Data from 40 participants, with 20 in each gestational-age group, were analyzed.

Table 1. Patient Enrollment and Exclusion Flow

Total Assessed = 75	Patient Status / Reasons for Exclusion
Excluded (n = 35)	
18	Established labor or compromised fetal status within 24 hours of admission
13	Established labor or compromised fetal status during the latency period
4	Developed signs of chorioamnionitis during the latency period at < 34 weeks
Analyzed (n = 40)	
20	Gestational age at delivery between 28 and 33^{+6} weeks (Group 1)
20	Gestational age at delivery between 34 and 33^{+6} weeks (Group 2)

4.2. Demographic and Clinical Characteristics

Baseline maternal and clinical characteristics are presented in Table 2. Mean maternal age was 28.2 ± 6.5 years in Group 1 and 28.1 ± 5.4 years in Group 2 ($P = 0.979$). Mean gravidity was 1.8 ± 0.9 and 2.2 ± 1.1 in Groups 1 and 2, respectively ($P = 0.249$). Overall, 29 women (72.5%) had no history of miscarriage. There were no statistically significant differences between groups in maternal age, gravidity, history of abortion, or underlying maternal disease.

Table 2. Demographic, Obstetric, Maternal, and Perinatal Outcomes of the Study Groups [a]

Variables	Expectant Management: Group 1 (Delivery at 28 to 33^{+6} Weeks; n = 20)	Expectant Management: Group 2 (Delivery at 34 to 36^{+6} Weeks; n = 20)	P Value
Maternal age (years)	28.2 ± 6.5	28.1 ± 5.4	0.979
Gravidity	1.8 ± 0.9	2.2 ± 1.1	0.249
History of abortion	6 (30)	5 (25)	0.241
Apgar score at 1 min	7.7 ± 1.2	9.3 ± 0.9	< 0.001
Apgar score at 5 min	7.9 ± 0.9	9.6 ± 0.8	< 0.001
Underlying disease	6 (30)	4 (20)	0.716
Admission to NICU	17 (85)	3 (15)	< 0.001
Hypoglycemia	17 (85)	1 (5)	< 0.001
RDS	10 (50)	2 (10)	0.006
Sepsis	1 (5)	6 (30)	0.006
Hyperbilirubinemia	7 (35)	4 (20)	0.480
Chorioamnionitis	1 (5)	-	1.000
Puerperal infection	2 (10)	-	0.467
Postpartum hemorrhage	2 (10)	-	0.487
Cesarean delivery	12 (60)	13 (65)	1.000

[a] Values are expressed as mean ± SD or No. (%). Percentages are calculated using n = 20 per group. $P < 0.05$ indicates statistical significance. Abbreviations: NICU, neonatal intensive care unit; RDS, respiratory distress syndrome.

4.3. Neonatal and Maternal Outcomes

Neonatal outcomes differed significantly between the two gestational-age groups (Table 2). Admission to the neonatal intensive care unit was significantly more frequent in Group 1 than in Group 2 (85% vs. 15%, $P < 0.001$). Respiratory distress syndrome was also significantly more prevalent in Group 1 (50% vs. 10%, $P = 0.006$), as was neonatal hypoglycemia (85% vs. 5%, $P < 0.001$).

Apgar scores at 1 and 5 minutes were significantly lower in Group 1 than in Group 2 (7.7 ± 1.2 vs. 9.3 ± 0.9 at 1 minute, $P < 0.001$; 7.9 ± 0.9 vs. 9.6 ± 0.8 at 5 minutes, $P < 0.001$). Neonatal sepsis was the only adverse outcome significantly more frequent in Group 2 than in Group 1 (30% vs. 5%, $P = 0.006$). There were no neonatal deaths, cases of intraventricular hemorrhage, or cases of necrotizing enterocolitis among the 40 live births.

Maternal complication rates did not differ significantly between the groups: postpartum hemorrhage occurred in 10% of Group 1 and 0% of Group 2 ($P = 0.487$), puerperal infection in 10% and 0%, respectively ($P = 0.467$), and chorioamnionitis in 5% and 0%, respectively ($P = 1.000$). Mode of delivery also did not differ significantly, with

cesarean delivery rates of 60% in Group 1 and 65% in Group 2 (P = 1.000).

5. Discussion

Preterm birth is a leading cause of infant and maternal deaths worldwide (2) and remains a major obstetric challenge with a complex pathogenesis. Preterm prelabor rupture of membranes near term may result from physiologic weakening of the membranes combined with the force of contractions (16). This study evaluated outcomes of expectant management of PPROM according to GA at delivery, comparing delivery at 28 to 33^{+6} weeks with delivery at 34 to 33^{+6} weeks.

The 40 women with singleton pregnancies and early PPROM had favorable outcomes, with no maternal or neonatal deaths. In contrast, Goodfellow et al. reported higher maternal and infant mortality in UK maternity hospitals (17). Differences between the cohorts may explain these findings. The UK study included 330 women with singleton pregnancies and 38 with multiple pregnancies, and PPROM occurred much earlier, between 16^{+0} and 22^{+6} weeks of gestation. Other research has shown that PPROM before 24 weeks is associated with high rates of intrauterine fetal death, preterm birth, and postpartum mortality (18). Our observations suggest that expectant management of PPROM may be extended beyond 34 weeks with careful clinical monitoring. Similarly, Bohilțea et al. reported that the benefits depend largely on management during the latency period and GA at membrane rupture (4).

Approximately half of the 2 million stillbirths occurring worldwide each year are preventable (19). In our study, no stillbirths or contraindications to continuing the pregnancy until 34 or 36 weeks of gestation were reported. No stillbirths or neonatal deaths were observed. Antenatal care programs incorporating expectant management of PPROM may therefore help minimize the risk of stillbirth.

The prevalence of admission to the NICU, hypoglycemia, RDS, and sepsis was significantly higher among women receiving expectant management from 28 to 34 weeks than among those receiving expectant management from 28 to 36 weeks. Thus, in the absence of fetal compromise or overt signs of infection, expectant management of PPROM may be continued until at least 36 weeks of gestation in this region of Iran. Another study concluded that expectant management with appropriate surveillance of maternal and fetal well-being should be followed in pregnant women presenting with ruptured membranes close to term (20). Expectant management may therefore be a useful component of routine antenatal care programs.

In a review of potentially curative approaches to spontaneous PPROM, Danciu et al. (21) reported that no curative treatment is currently available for PPROM, a major cause of preterm birth. A notable feature of the present study was that all participants received the same antibiotic regimen for 7 days and completed a course of corticosteroids.

The Apgar score provides a rapid assessment of newborns immediately after birth and in response to resuscitation, supporting care for newborns and their families (22). As expected, Apgar scores were significantly lower among women with PPROM who underwent expectant management and delivered at 28 to 33^{+6} weeks. Hong et al. (23) reported that elective induction at 39 weeks was associated with a reduced likelihood of a low 5-minute Apgar score compared with expectant management. The relationship between expectant management and labor induction warrants further investigation.

5.1. Limitations

This study has several limitations. First, it was conducted at a single center, Imam Reza Hospital in Kermanshah, which may limit generalizability to other settings. Second, the sample size was relatively small (n = 40), reducing statistical power for subgroup or multivariable analyses. Third, selection bias is a potential concern because patients who developed early complications or active labor during the latency period were excluded. Large multicenter prospective studies are needed to validate these observations.

5.2. Conclusions

These findings provide insights for health care providers counseling women with PPROM. Our observations suggest that expectant management until at least 36 weeks of gestation may be considered with careful maternal and fetal monitoring when there is no evidence of infection.

Footnotes

AI Use Disclosure: The authors declare that no generative artificial intelligence (AI) tools were used in the creation of this article.

Authors' Contribution: Study Design: F. V. and M. Z.; Data Collection: A. F.; Data Analysis: M. Z.; Final Report and Manuscript Writing: F. V., M. Z., and Y. G.; All authors read and approved the final version for submission.

Conflict of Interests Statement: The authors declare no conflicts of interest.

Data Availability: The dataset is available on request from the corresponding author during submission.

Ethical Approval: This study was approved by the Ethics Committee of Kermanshah University of Medical Sciences (IR.KUMS.MED.REC.1400.84).

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References

1. Adane HA, Iles R, Boyle JA, Collie A. Maternal occupational risk factors and preterm birth: Protocol for a systematic review and meta-analysis. *Plos one*. 2023;**18**(7). e0283752. [PubMed ID: 37432928]. [PubMed Central ID: PMC10335685]. https://doi.org/10.1371/journal.pone.0283752.
2. Born too soon: decade of action on preterm birth [Internet]. *Born too soon: decade of action on preterm birth [Internet]*. Geneva: World Health Organization; 2023, [cited 2026 Nov 8]. Geneva: World Health Organization; 2023. Available from: https://www.who.int/publications/i/item/9789240073890/.
3. Bond DM, Middleton P, Levett KM, van der Ham DP, Crowther CA, Buchanan SL, et al. Planned early birth versus expectant management for women with preterm prelabour rupture of membranes prior to 37 weeks' gestation for improving pregnancy outcome. *Cochrane Database of Systematic Reviews*. 2017;**2017**(3):CD004735. [PubMed ID: 28257562]. [PubMed Central ID: PMC6464692]. https://doi.org/10.1002/14651858.CD004735.pub4.
4. Bohilțea RE, Cioca AM, Dima V, Ducu I, Grigoriu C, Varlas V, et al. Expectant management of PPROM improves neonatal outcome-a retrospective study of 562 patients. *Journal of Clinical Medicine*. 2021;**11**(1):214. [PubMed ID: 35011954]. [PubMed Central ID: PMC8745911]. https://doi.org/10.3390/jcm11010214.
5. Hagen ID, Bailey JM, Zielinski RE. Outcomes of expectant management of term prelabor rupture of membranes. *Journal of Obstetric, Gynecologic & Neonatal Nursing*. 2021;**50**(2):122-32. [PubMed ID: 33493463]. https://doi.org/10.1016/j.jogn.2020.10.010.
6. Sylvester MA, Mintz G, Sisti G. Maternal outcomes following active vs. expectant management of previable preterm pre-labor rupture of membranes: a meta-analysis. *Children*. 2023;**10**(8):1347. [PubMed ID: 37628346]. [PubMed Central ID: PMC10453507]. https://doi.org/10.3390/children10081347.
7. Sklar A, Sheeder J, Davis AR, Wilson C, Teal SB. Maternal morbidity after preterm premature rupture of membranes at < 24 weeks' gestation. *American journal of obstetrics and gynecology*. 2022;**226**(4):558-558.e11. [PubMed ID: 34736914]. https://doi.org/10.1016/j.ajog.2021.10.036.
8. Yüzen D, Graf I, Tallarek AC, Hollwitz B, Wiessner C, Schleussner E, et al. Increased late preterm birth risk and altered uterine blood flow upon exposure to heat stress. *EBioMedicine*. 2023;**93**. 104651. [PubMed ID: 37355458]. [PubMed Central ID: PMC10363435]. https://doi.org/10.1016/j.ebiom.2023.104651.
9. Rutayisire E, Mochama M, Ntihabose CK, Utumatwishima JN, Habtu M. Maternal, obstetric and gynecological factors associated with preterm birth in Rwanda: findings from a national longitudinal study. *BMC Pregnancy and Childbirth*. 2023;**23**(1). 365. [PubMed ID: 37208655]. [PubMed Central ID: PMC10197396]. https://doi.org/10.1186/s12884-023-05653-y.
10. Singh N, Pattnaik L, Panda SR, Jena P, Panda J. Fetomaternal outcomes in women affected with preterm premature rupture of membranes: an observational study from a tertiary care center in Eastern India. *Cureus*. 2022;**14**(5):e25533. [PubMed ID: 35800788]. [PubMed Central ID: PMC9246467]. https://doi.org/10.7759/cureus.25533.
11. Garg A, Jaiswal A. Evaluation and management of premature rupture of membranes: a review article. *Cureus*. 2023;**15**(3):e36615. [PubMed ID: 37155446]. [PubMed Central ID: PMC10122752]. https://doi.org/10.7759/cureus.36615.
12. Vakilian K, Ranjbaran M, Khorsandi M, Sharafkhani N, Khodadost M. Prevalence of preterm labor in Iran: A systematic review and meta-analysis. *International Journal of Reproductive BioMedicine*. 2015;**13**(12):743-748. [PubMed ID: 27141533]. [PubMed Central ID: PMC4827509]. https://doi.org/10.29252/ijrm.13.12.743.
13. Chawanpaiboon S, Vogel JP, Moller AB, Lumbiganon P, Petzold M, Hogan D, et al. Global, regional, and national estimates of levels of preterm birth in 2014: a systematic review and modelling analysis. *The Lancet global health*. 2019;**7**(1):e37-e46. [PubMed ID: 30389451]. [PubMed Central ID: PMC6293055]. https://doi.org/10.1016/S2214-109X(18)30451-0.
14. Shirazi M, Sina M, Hantoushzadeh S, Golshahi F, Sahebdel B, Feizabad E, et al. The Role of Uterocervical Angle on Preterm Birth Incidence. *Journal of Nursing and Midwifery Sciences*. 2024;**11**(4). https://doi.org/10.5812/jnms-151504.
15. Borna S, Eshraghi N, Hantoushzadeh S, Ghotbizadeh Vahdani F, Panahi Z, Jafarabady K, et al. The Effect of Vaginal Progesterone in Reducing Preterm Birth in Women with an Increased Uterocervical Angle: A Randomized Controlled Trial. *Journal of Nursing and Midwifery Sciences*. 2025;**12**(4). https://doi.org/10.5812/jnms-160082.
16. Dayal S, Jenkins SM, Hong PL. *National Institutes of Health*. StatPearls Publishing; 2024, [cited 2026 Nov 8]. Preterm and term prelabor rupture of membranes (PPROM and PROM) [updated 2024 Oct 31]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK532888/.
17. Goodfellow L, Care A, Curran C, Roberts D, Turner MA, Knight M, et al. Preterm Prelabour Rupture Of Membranes (PPROM) before 23 weeks gestation: A prospective observational study. *medRxiv*. 2023. https://doi.org/10.1101/2023.03.07.23286863.
18. Gauthier-Moulinier H, Ndour D, Rabilloud M, Nguyen K. Outcomes of pregnancies with preterm premature rupture of membranes occurring before 24 weeks of gestation: An 11-year observational study. *International Journal of Gynecology & Obstetrics*. 2023;**162**(2):590-5. [PubMed ID: 36707064]. https://doi.org/10.1002/ijgo.14700.
19. Atkins B, Kindinger L, Mahindra MP, Moatti Z, Siassakos D. Stillbirth: prevention and supportive bereavement care. *BMJ medicine*. 2023;**2**(1). e000262. [PubMed ID: 37564829]. [PubMed Central ID: PMC10410959]. https://doi.org/10.1136/bmjmed-2022-000262.
20. Morris JM, Roberts CL, Bowen JR, Patterson JA, Bond DM, Algert CS, et al. Immediate delivery compared with expectant management after preterm pre-labour rupture of the membranes close to term (PPROMT trial): a randomised controlled trial. *The Lancet*. 2016;**387**(10017):444-52. [PubMed ID: 26564381]. https://doi.org/10.1016/S0140-6736(15)00724-2.
21. Danciu BM, Oţelea MR, Marincaş MA, Niţescu M, Simionescu AA. Is spontaneous preterm prelabor of membrane rupture irreversible? A review of potentially curative approaches. *Biomedicines*. 2023;**11**(7):1900. [PubMed ID: 37509539]. [PubMed Central ID: PMC10377155]. https://doi.org/10.3390/biomedicines11071900.
22. Prasetya SCH. Duration of Premature Rupture of Membranes with Infant APGAR Score in PROM Patients at Banten Hospital in 2023. *INOMED: International Journal of Occupational Medicine and Public Health*. 2024;**1**(1). https://doi.org/10.62870/inomed.v1i1.25997.
23. Hong J, Atkinson J, Roddy Mitchell A, Tong S, Walker SP, Middleton A, et al. Comparison of maternal labor-related complications and

neonatal outcomes following elective induction of labor at 39 weeks of gestation vs expectant management: a systematic review and meta-analysis. *JAMA network open*. 2023;**6**(5):e2313162-e. [PubMed ID: 37171818]. [PubMed Central ID: PMC10182428]. https://doi.org/10.1001/jamanetworkopen.2023.13162.