Original Article

Obstetric and Perinatal Outcomes in Preterm Prelabor Rupture of Membranes: A Two-Year Retrospective Analysis»

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ABSTRACT

Objective

To evaluate the structure of obstetric complications and the pattern of perinatal morbidity in preterm prelabor rupture of membranes (PPROM) based on a retrospective analysis of clinical data from three obstetric institutions in Aktobe (Aktobe region, Republic of Kazakhstan) over a two-year period.

Materials and Methods

A retrospective study including 428 women with singleton pregnancies complicated by PPROM who delivered in three perinatal institutions was conducted. Clinical and obstetric characteristics, duration of the latency period, mode of delivery, obstetric complications, and perinatal outcomes were analyzed. Statistical analysis included the χ^2 test, Spearman correlation analysis, and ROC analysis to assess the prognostic value of the duration of the latency period.

Results

An increase in the duration of the latency period was significantly associated with a higher incidence of chorioamnionitis and an increased rate of cesarean delivery ($p < 0.001$). A prolonged latency period was accompanied by a higher incidence of intrauterine infection and lower Apgar scores ($r = -0.357$; $p = 0.001$), whereas respiratory distress syndrome was more frequently observed when the latency period exceeded 168 hours. ROC analysis demonstrated a moderate but statistically significant predictive value of the duration of the latency period for intrauterine infection (AUC = 0.62; $p < 0.001$).

Conclusion

The duration of the latency period in PPROM is an important factor influencing the development of obstetric and perinatal complications. The findings support the need for an individualized approach to the management of pregnancies complicated by PPROM, taking into account the risk of infectious and neonatal complications.

Keywords

latency period; chorioamnionitis; neonatal outcome; intrauterine infection; PPROM.

INTRODUCTION

Preterm prelabor rupture of membranes (PPROM) is defined as the rupture of the fetal membranes prior to the onset of regular uterine contractions at a gestational age of less than 37 weeks. It remains a major contributor to preterm birth and adverse perinatal outcomes[1,2]. PPROM continues to pose a significant challenge in contemporary obstetric practice due to its strong association with both maternal and neonatal complications[1,3,4].

The clinical importance of PPROM lies in the dual risk profile related to prematurity and infectious-inflammatory processes. Ascending infection is a central mechanism in the pathogenesis of membrane rupture and contributes to the development of chorioamnionitis, intrauterine infection, and neonatal sepsis[56]. Histopathological evidence of chorioamnionitis is closely linked to unfavorable neonatal outcomes and increased perinatal morbidity[78].

At the same time, fetal maturity—particularly pulmonary development—plays a crucial role in determining the risk of complications such as respiratory distress syndrome (RDS), intraventricular hemorrhage, and other sequelae of prematurity[9,10,11]. According to current clinical guidelines, expectant management may be appropriate in cases of PPROM in the absence of

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infection or fetal compromise; however, this approach necessitates vigilant monitoring due to the progressively increasing risk of intra-amniotic inflammation with prolonged membrane rupture[2,12].

Systematic reviews and randomized studies indicate that prolongation of pregnancy may reduce the incidence of respiratory complications by increasing gestational age, but it is also accompanied by a gradual rise in infectious risks [13,17,18]. Thus, the clinical management strategy for PPROM represents a balance between the risks of prematurity and ascending infection.

Despite the availability of international clinical guidelines, the contribution of the duration of the latency period to obstetric and perinatal outcomes in real-world clinical practice across different regions remains a subject of ongoing debate [14-16].

Although the clinical management of PPROM has been extensively studied, the relationship between the duration of the latency period and the risk of specific obstetric and neonatal complications remains inconsistent across different populations and healthcare settings. In particular, limited data are available from Central Asian countries, including Kazakhstan, where regional clinical practices and perinatal care resources may differ from those reported in large international studies.

Therefore, the present retrospective study aimed to evaluate the structure of obstetric complications and perinatal morbidity in PPROM depending on the duration of the latency period.

MATERIALS AND METHODS

A retrospective study was conducted based on the analysis of medical records of women with singleton pregnancies complicated by preterm prelabor rupture of membranes (PPROM) who delivered in three perinatal institutions in Western Kazakhstan: Aktobe Medical Center, the Regional Perinatal Center, and Kargaly City Hospital over a two-year period.

Inclusion criteria were singleton pregnancy, gestational age from 22+0 to 36+6 weeks, clinically confirmed PPROM, and delivery in one of the above-mentioned institutions. Medical records were excluded from the study if they involved multiple pregnancy, iatrogenic rupture of membranes (amniotomy), congenital fetal anomalies, intrauterine fetal death before the onset of PPROM, or incomplete medical documentation.

The diagnosis of PPROM was established based on clinical data (medical history and complaints of leakage of amniotic fluid), findings of vaginal examination, and additional diagnostic methods in accordance with the Clinical Protocol for Diagnosis and Treatment of the Ministry of Health of the Republic of Kazakhstan No. 181 dated May 26, 2023, “Premature Rupture of Membranes. Prelabor Rupture of Amniotic Fluid.”

The analyzed parameters included maternal age, gestational age at the time of PPROM, duration of the latency period, mode of delivery, onset of labor, obstetric complications (chorioamnionitis, placental abruption, postpartum endometritis), and perinatal outcomes (birth weight, Apgar score, need for respiratory support, intrauterine infection, respiratory distress syndrome, intraventricular hemorrhage, sepsis, and perinatal mortality).

The latency period was calculated in hours as the time interval between rupture of the fetal membranes and delivery. For analytical purposes, it was stratified into three groups: ≤50 hours, 50–168 hours, and >168 hours (7 days).

Statistical analysis was performed using SPSS software. Continuous variables are presented as mean ± standard deviation (SD), whereas categorical variables are expressed as frequencies and percentages. Differences in categorical variables were assessed using the Pearson chi-square (χ^2) test. Correlation analysis was performed using the Spearman rank correlation coefficient. The receiver operating characteristic (ROC) curve analysis was conducted to evaluate the predictive value of latency period duration for the risk of intrauterine infection. A p-value <0.05 was considered statistically significant.

ETHICAL CLEARENCE

The study was approved by the Local Ethics Committee of Marat Ospanov West Kazakhstan Medical University (Protocol No. 11 dated November 28, 2023).

The study was conducted in accordance with the ethical principles of the Declaration of Helsinki of the World Medical Association (Fortaleza revision, 2013).

RESULTS

The study included 428 women with singleton pregnancies complicated by preterm premature rupture of membranes (PPROM) who delivered at the Aktobe Medical Center, the Regional Perinatal Center, and the

Kargaly City Hospital over a two-year period.

The mean maternal age was 30.7 ± 6.0 years (range 19–43 years). The mean gestational age at the time of PPROM was 33.1 ± 3.3 weeks (range 22.1–37.0 weeks). The mean duration of the latency period was 85.9 ± 145.2 hours, with a maximum value of 890 hours, reflecting a wide variability of this parameter. Such prolonged latency periods were rare and occurred under close clinical monitoring.

In 56.5% of patients, the latency period did not exceed 50 hours, in 31.5% it ranged from 50 to 168 hours, and in 11.9% it exceeded 168 hours. The distribution of patients according to the duration of the latency period is presented in Figure 1.

Delivery occurred predominantly via vaginal birth in 73.8% (316) of cases, while cesarean section was performed in 25.9% (111). Spontaneous onset of labor was observed in 67.1% (287) of patients, whereas labor induction was performed in 32.9% (141).

During labor, the following obstetric complications were diagnosed: chorioamnionitis in 13.3% (57) of cases, fetal distress in 6.8% (29), and meconium-stained amniotic fluid in 2.3% (10) of patients. Placental abruption was identified in 8.4% (36) of cases. Postpartum endometritis was recorded in 1.9% (8) of patients. The stillbirth rate was 1.4% (6).

Analysis of obstetric complications revealed a significant association between the duration of the latency period and the development of chorioamnionitis (χ^2, $p < 0.001$). The incidence of chorioamnionitis increased progressively with increasing latency period duration, reaching 49.0% (25) in the group with a latency period of more than 168 hours.

The mode of delivery was also significantly associated with the duration of the latency period ($p < 0.001$). In the group with a latency period exceeding 168 hours, the proportion of cesarean deliveries reached 54.9%, which was nearly two times higher than in the group with a latency period of less than 50 hours (27.7%).

Analysis of the onset of labor showed that the frequency of labor induction increased with increasing latency period duration, whereas spontaneous onset of labor predominated in cases with shorter latency periods ($p < 0.001$).

No significant association was found between the duration of the latency period and the incidence of postpartum endometritis ($p = 0.175$), suggesting the absence of a direct relationship between this complication and prolonged latency period under conditions of ongoing clinical management.

The association between latency period duration and obstetric complications is presented in Table 1.

Perinatal outcomes and the condition of newborns in the study group were analyzed. The mean birth weight was 2210 ± 646 g (range 500–3900 g), reflecting the high proportion of preterm infants in the study population.

The mean duration of neonatal stay in the neonatal pathology unit was 7.8 ± 11.4 days, while the mean total length of hospitalization until discharge was 10.9 ± 13.6 days, with a maximum stay of 92 days.

Most newborns (71.0%, n = 304) did not require treatment in the neonatal intensive care unit (NICU). At the same time, 29.0% (n = 124) of newborns required intensive care support of varying duration. Short-term stay in the intensive care unit (1–3 days) was observed in 12.6% (n = 54) of newborns, whereas longer intensive care support was required in 16.4% (n = 70) of infants.

Prolonged intensive care (≥5 days) was required in 14.7% (63 of 428) newborns, with a maximum NICU stay of 77 days.

In the structure of neonatal morbidity among the studied newborns (n = 428), respiratory and infectious complications were most frequently observed. These included respiratory failure (25.9%, n = 111), respiratory distress syndrome (22.7%, n = 97), intrauterine infection (22.9%, n = 98), and neonatal sepsis (5.1%, n = 22). Intraventricular hemorrhage was reported less frequently (5.4%, n = 23), reflecting the predominance of respiratory and infectious complications among infants born from pregnancies complicated by PPROM.

Data on perinatal outcomes are presented in Table 2.

Perinatal outcomes according to the duration of the latency period

The analysis demonstrated a statistically significant association between the duration of the latency period and several perinatal complications.

The incidence of respiratory distress syndrome (RDS) differed significantly between the groups ($p < 0.001$). The highest rate of RDS was observed in cases with a prolonged latency period exceeding 168 hours (58.8%), whereas it was 18.2% in the group with a latency period of ≤50 hours and 17.0% in the 50-168 hour group. This

pattern may reflect the influence of both infectious factors and gestational age at the time of delivery.

Similarly, the incidence of intrauterine infection (IUI) increased with prolongation of the latency period ($p = 0.002$), reflecting the role of ascending infection during prolonged exposure of the fetal membranes to vaginal microflora. The rate of IUI was 16.5% in cases with a latency period of ≤50 hours, 31.1% when the latency period was 50–168 hours, and 31.4% when it exceeded 168 hours.

No statistically significant association was found between the duration of the latency period and the incidence of intraventricular hemorrhage ($p = 0.860$) or neonatal sepsis ($p = 0.145$).

Correlation analysis demonstrated a moderate negative correlation between the duration of the latency period and the Apgar score ($r = -0.357$; $p = 0.001$), which may reflect the combined influence of intra-amniotic inflammation and prematurity.

The correlation between latency period duration and Apgar score is presented in Figure 2.

Predictive value of latency period duration for intrauterine infection

To evaluate the diagnostic accuracy of latency period duration in predicting intrauterine infection (IUI), a receiver operating characteristic (ROC) curve analysis was performed.

The area under the ROC curve (AUC) was 0.62 (95% CI: 0.55–0.68; $p < 0.001$). An AUC of 0.62 indicates a moderate discriminative ability.

The optimal cut-off value for latency period duration was 44 hours, at which the sensitivity of the model was 61.2% and specificity was 58.5%. These results indicate a statistically significant but clinically limited predictive value of latency period duration as an independent risk factor for intrauterine infection.

The ROC curve illustrating the predictive value of latency period duration is presented in Figure 3.

When analyzing the predictive value of latency period duration for other neonatal outcomes, no statistically significant ROC models were identified; therefore, these outcomes were not included in further analysis.

Neonatal outcomes

Most newborns (84.1%, n = 360) were discharged in satisfactory condition, whereas 8.4% (n = 36) required transfer to tertiary municipal hospitals for further treatment and rehabilitation. The early neonatal mortality rate was 7.5% (n = 32), underscoring the clinical importance of PPROM as a major contributor to adverse perinatal outcomes.

Antepartum hospitalization

The majority of patients (96.7%, n = 414) were hospitalized once prior to delivery, whereas recurrent hospitalizations (two or more) were observed in 3.3% (n = 14) of women.

DISCUSSION

The present study demonstrated that the duration of the latency period is a significant factor influencing the incidence of infectious and neonatal complications in pregnancies complicated by PPROM. These findings are consistent with previous studies demonstrating that prolongation of the latency period in PPROM is associated with an increased risk of infectious complications, including chorioamnionitis and intrauterine infection, while at the same time allowing further fetal maturation and potential improvement in neonatal outcomes [7,8,18]. In agreement with previous studies, the present findings indicate that prolonged rupture of membranes is associated with an increased risk of intra-amniotic infection. Kim et al. emphasized the role of intra-amniotic inflammation and ascending infection in the pathogenesis of PPROM and its complications. Similarly, Waters and Mercer reported that although expectant management may allow further fetal maturation, prolonged latency is associated with a gradual increase in infectious risks and neonatal morbidity [6,15]. The obtained data confirm that prolongation of pregnancy is accompanied by a gradual increase in the risk of chorioamnionitis, intrauterine infection, and respiratory disorders in newborns.

The observed association between a longer latency period and deterioration of neonatal condition at birth may reflect the role of intra-amniotic inflammation in the development of neonatal respiratory complications. These findings are consistent with current concepts regarding the pathogenetic role of ascending infection in PPROM.

The increased rate of cesarean delivery in cases with prolonged latency period likely reflects the clinical

need to minimize infectious and hypoxic risks in the presence of fetal compromise.

At the same time, the moderate predictive value of latency period duration (AUC = 0.62) indicates that this parameter cannot be used as an independent criterion for clinical decision-making and should be considered in combination with other maternal and fetal risk factors.

The findings of this study emphasize the importance of an individualized approach to the management of pregnancies complicated by PPROM, taking into account gestational age and clinical signs of infection. Despite the increased risk of intrauterine infection with prolonged rupture of membranes, expectant management in early gestational ages aims to reduce complications associated with prematurity. Even a short prolongation of pregnancy may allow for antenatal prevention of respiratory distress syndrome and improvement of neonatal outcomes.

The limitations of the study include its retrospective design and the fact that it was conducted within a single geographic region, which may limit the generalizability of the findings to other populations.

CONCLUSION

The results of this retrospective study demonstrate that preterm prelabor rupture of membranes (PPROM) is associated with a high incidence of obstetric and perinatal complications, the severity of which is largely determined by the duration of the latency period.

An increase in the duration of the latency period was significantly associated with a higher incidence of chorioamnionitis and an increased rate of cesarean delivery. At the same time, prolongation of the latency period was not associated with a statistically significant increase in postoperative infectious complications in the mother, suggesting the potential safety of expectant management under careful clinical monitoring.

A prolonged latency period was also associated with an increased incidence of intrauterine infection and lower Apgar scores in newborns. In addition, respiratory distress syndrome was more frequently observed when the latency period exceeded 168 hours, which may reflect the influence of intra-amniotic inflammation and gestational age–related factors.

ROC analysis demonstrated a moderate but statistically significant predictive value of latency period duration for the risk of intrauterine infection, suggesting that this parameter may serve as an additional indicator in the stratification of perinatal risk.

The findings of this study highlight the important role of latency period duration in determining the clinical management strategy for pregnancies complicated by PPROM. These results support the need for a personalized obstetric approach aimed at improving clinical decision-making and reducing adverse perinatal outcomes.

INFORMED CONSENT

Due to the retrospective design of the study and the use of anonymized medical records, the requirement for obtaining written informed consent from patients was waived by the ethics committee.

GENDER POLICY

Only women were included in the study, given the nature of the investigated condition (PPROM).

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

S.Yu. Shikanova — study concept and design, data analysis, manuscript preparation.

A.A. Nurmagambetova — data collection, statistical analysis, interpretation of results, manuscript editing.

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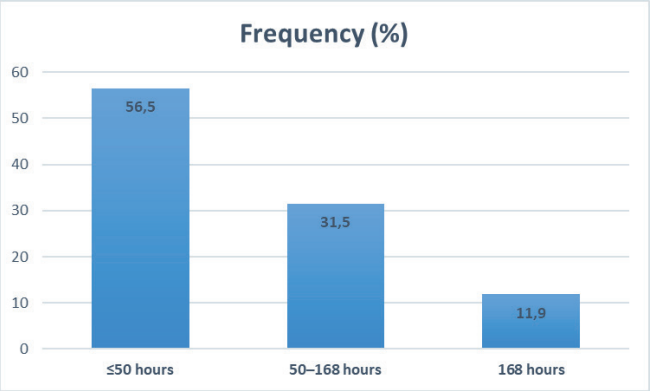

Figure 1. Distribution of patients with PPROM according to latency period duration

Table 1. Association of latency period duration with obstetric complications and mode of delivery

Variable	≤50 h (n=242)	50–168 h (n=135)	>168 h (n=51)	p-value
Chorioamnionitis, n (%)				<0.001
Yes	16 (6.6)	16 (11.9)	25 (49.0)	
No	226 (93.4)	119 (88.1)	26 (51.0)	
Mode of delivery, n (%)				<0.001
Vaginal delivery	192 (79.3)	92 (68.1)	32 (62.7)	
Cesarean section	50 (20.7)	43 (31.9)	19 (37.3)	
Onset of labor, n (%)				<0.001
Spontaneous	187 (77.3)	78 (57.8)	22 (43.1)	
Labor induction	55 (22.7)	57 (42.2)	29 (56.9)	

Note. Data are presented as n (%). Statistical significance was assessed using the Pearson chi-square (χ^2) test.

Table 2. Association between latency period duration and neonatal outcomes

Variable	≤50 h (n=242)	50–168 h (n=135)	>168 h (n=51)	p-value
Respiratory distress syndrome (RDS), n (%)				<0.001
Yes	44 (18.2)	23 (17.0)	30 (58.8)	
No	198 (81.8)	112 (83.0)	21 (41.2)	
Intrauterine infection (IUI), n (%)				0.002
Yes	40 (16.5)	42 (31.1)	16 (31.4)	
No	202 (83.5)	93 (68.9)	35 (68.6)	
Neonatal sepsis, n (%)				0.145
Yes	8 (3.3)	10 (7.4)	4 (7.8)	
No	234 (96.7)	125 (92.6)	47 (92.2)	
Intraventricular hemorrhage (IVH), n (%)				0.860
Yes	14 (5.8)	7 (5.2)	2 (3.9)	
No	228 (94.2)	128 (94.8)	49 (96.1)	

Note. Data are presented as n (%). Statistical significance was assessed using the Pearson chi-square (χ^2) test.

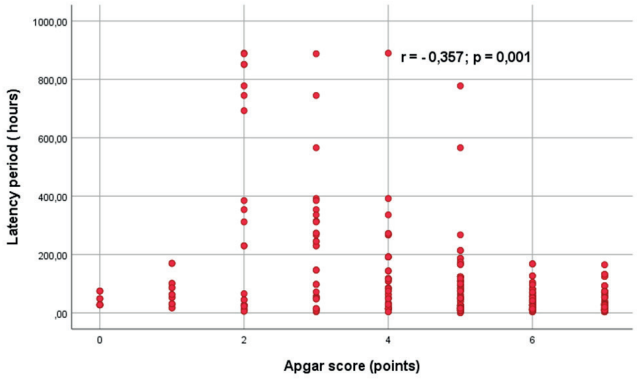

Figure 2. Correlation between latency period duration and Apgar score (r = −0.357; p = 0.001).

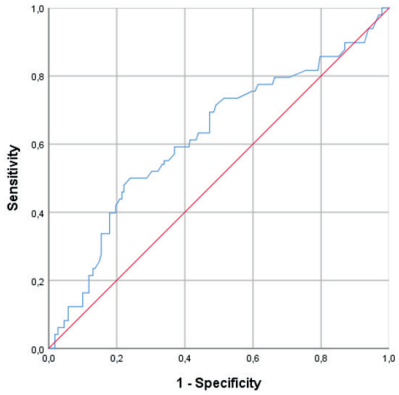

Figure 3. ROC curve demonstrating the predictive value of latency period duration for the risk of intrauterine infection (AUC = 0.62; 95% CI: 0.55–0.68).

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