

# Pregnancy Outcome After Preterm Rupture of the Membranes Before or After 34 Weeks' Gestation in a Private Tertiary Referral Hospital

Aysel DERBENT<sup>1</sup>, Serap SİMAVLI<sup>1</sup>, İlknur İNEGÖL GÜMÜŞ<sup>1</sup>, Candan İLTEMUR DUVAN<sup>1</sup>, Hasan KAFALI<sup>1</sup>  
M.Mansur TATLI<sup>2</sup>, Nilgün ÖZTÜRK TURHAN<sup>1</sup>

Ankara, Turkey

**OBJECTIVE:** To investigate the outcome of premature rupture of the membranes (PROM) before and after 34 weeks of gestation.

**STUDY DESIGN:** A retrospective study, including 85 women with PPRM and 249 women with PROM during the years 2007-2010, was conducted. Data were analyzed using the chi-squared test, the Mann-Whitney test, and Spearman's correlation analysis.

**RESULTS:** Whereas, twin pregnancy was linked to the occurrence of PROM before 34 week, GDM and/or polyhydramnios were seen in the etiology after 34 weeks' The latency period between PROM and delivery of the fetus was significantly longer before 34 weeks' gestation ( $p < 0.001$ ). Admission to the NICU and length of stay were found to be higher in the newborns from this group ( $p < 0.001$ ). They were also associated higher infectious neonatal problems, such as sepsis and pneumonia compared to 34-37 weeks subgroup ( $p < 0.001$ ).

**CONCLUSIONS:** PPRM before 34 weeks had a longer latency, and led to more infectious morbidity and mortality in newborns.

**Key Words:** Preterm labor, Preterm PROM, Prematurity, Amniotic fluid

Gynecol Obstet Reprod Med;2010;16:135-40

## Introduction

Spontaneous rupture of membranes before the onset of labor is referred as premature rupture of the membranes (PROM). If that occurs before 37 weeks of gestation defined as preterm PROM (PPROM). Although membran rupture at term usually occurs as a result of a physiologic, and progressive membrane weakening, PPRM can result from pathologic weakening of the fetal membranes which has several causes.<sup>1</sup> Latency is defined as the interval between rupture of the membranes and the onset of labor which increases with decreasing gestational age at membran rupture.<sup>2</sup> When PROM occurs before 34 weeks of gestation, 93% of women will deliver within 1 week. Approximately 8-10% of pregnancies at term experience PROM, and 95% of these pregnant will de-

liver within 28 hours of membrane rupture. Because increased potential for perinatal infection, and prematurity, both PROM and PPRM can lead to perinatal mortality and morbidity.<sup>3</sup> In the past, perinatal risk factors, and maternal-neonatal outcomes of the PROM have been investigated. However, changes in socioeconomic factors, improvements in neonatal care and clinical management such as routine empiric antibiotic therapy considered us, there is a need to identify current status in the PROM and PPRM.<sup>4</sup>

The purpose of the present study was to evaluate all pregnant who admitted to our hospital because of the rupture of membranes between 24-41 weeks' gestation; determine factors affecting the latency period in pregnancies with PPRM and evaluate perinatal morbidity-mortality.

## Material and Method

We performed a retrospective analysis of patients admitted to Fatih University Hospital with PROM from September 2007 to April 2010. Pregnancies that were complicated by congenital fetal anomalies and uterine anomalies were excluded. Information regarding the maternal and neonatal progress was collected from the computerized hospital records. Data were recorded by residents of obstetrics and neonatology departments. Gestational age was based on a

Fatih University School of Medicine <sup>1</sup>Department of Obstetrics and Gynecology, <sup>2</sup>Department of Neonatology, Ankara

Address of Correspondence: Aysel Derbent  
Fatih University School of Medicine,  
Department of Obstetrics and  
Gynecology, Alparslan Türkeş Street  
No:57, Emek, Ankara  
ayseluyusal@hotmail.com

Submitted for Publication: 20. 08. 2010

Accepted for Publication: 25. 10. 2010

combination of the last menstrual period and ultrasound findings during the first trimester. The following clinical characteristics were evaluated: Maternal age, parity, latency period, gestational age at delivery, birth weight, multiple gestations and fertility treatment. The following pregnancy, labor and birth complications were assessed: hypertensive disorders (preeclampsia, eclampsia, and chronic hypertension), gestational diabetes mellitus (GDM), and pregestational diabetes mellitus, chorioamnionitis, and placental abruption. These risk factors were investigated during routine ultrasound screening at the admission: polyhydramnios (amniotic fluid index more than 24 cm), oligohydramnios (amniotic fluid index 5 cm or less). The following perinatal outcomes were assessed: type of delivery, birth weight, Apgar scores at the 1 and 5 minutes, congenital malformations, and length of hospitalization, and perinatal mortality.

Management protocol of our hospital for PROM is followed. After the diagnosis of membrane rupture is confirmed, gestational age is established by combination of menstrual dates and ultrasound findings. Fetal presentation, clinical findings of intrauterine and genito-urinary infection, placental abruption, fetal distress were assessed. In term pregnancies, induction of labor with intravenous (IV) oxytocin usually is recommended if women are not in labor. If gestational age smaller than 34 weeks conservative management was planned, which consist of bed rest in the hospital, serial evaluation for amnionitis, labor, abruption, fetal well-being and fetal growth. Betamethasone given a single course (two doses of 12 mg IM, 24 hours apart). We use therapeutic tocolysis to stop contractions until 34 weeks of gestation is completed. We use adjuvant antibiotic therapy to treat or prevent ascending decidual infection. Antibiotic protocol of our department is 2 gr of ampicillin IV every 6 hours and 250 mg of erythromycin IV every 6 hours for 48 hours followed by oral therapy for 5 days (250 mg of amoxicillin IV every 8 hours and 333 mg of enteric-coated erythromycin base PO every 8 hours). Routine GBS screening was not performed. It was recommended that women be given specific antibiotics if routine urine or service-vaginal cultures were showed a specific microorganism. Clinical chorioamnionitis was defined as maternal temperature before or during labor above 38°C; maternal white blood cell (WBC) count above 20,000/mm<sup>3</sup>; or foul-smelling amniotic fluid. Neonatal infection was defined as clinical signs of infection and a positive central culture or antigen detection test, chest radiograph compatible with pneumonia, positive Gram stain of cerebrospinal fluid (CSF), or histologic diagnosis of pneumonia (definite infection); or a high or low neutrophil count, a high ratio of immature neutrophils to total neutrophils, a high immature neutrophil count, or abnormal CSF findings (probable infection).

Based on gestational age at the time of PROM the patients

were divided into three different groups (<34 weeks, 34-37 weeks and ≥37 weeks. Analysis of the data was performed for the overall patient population and for subgroups.

Statistical analysis was performed using the SPSS package (SPSS, Chicago, IL, USA) Shapiro-Wilk test was used to evaluate the normal distribution of the variables. Since the data were not normally distributed, non-parametric test were used for analyses. Categorical variables were compared with Chi-square or Fisher Exact test. Mann-Whitney U-test was used to compare continuous variables. Spearman's correlation analysis was done to evaluate relationships between latency and other variables within group. A *p* value <0.05 was considered statistically significant.

## Results

Between September 2007 and April 2010, a total of 3029 deliveries were recorded. During this study period, 249(8%) pregnancies were hospitalized for PROM; 85(3%) hospitalized for PPROM and 17(20%) of those smaller than 34 weeks' gestation. Table 1 displays the baseline characteristics of pregnancies complicated by PROM and PPROM. We found no significant differences for maternal age, number of pregnancy, parity, history of PPROM and effacement between PROM and PPROM pregnancies. Women with PROM had a higher median for cervical dilatation, and higher rates of positive valsalva sign (evidence of fluid pooling in the vagina, or leaking from the cervical os when the patient coughs or when fundal pressure is applied) at the initial examination. Rates of twin pregnancy, and CS delivery were higher in the PPROM group. The median latency period between admission and delivery of the fetus was significantly lower in the PROM group compared to the PPROM group (*p*<0.001). Apgar score at 5 min was lesser among the PPROM group in comparison to the PROM group. As well, higher rates of admission to NICU and significantly prolonged hospitalization at the NICU were found among infants in the PPROM group. No significant differences were noted between groups regarding leukocyte and CRP values, fetal sex, maternal and fetal tachycardia.

Table 2 showed that no significant differences were noted regarding gravidity, parity, fluid passage through the cervix with valsalva upon admission, detected infections during pregnancy, CRP and leukocyte values, AFI and Apgar scores between the subgroups of PPROM. The median overall latency period between PROM and delivery of the fetus was 48 h in <34 weeks subgroup of PPROM and 19 h in 34-37 weeks' subgroup of PROM. No statistically significant difference was found in the frequency of genito-urinary infections between the subgroups. No clinical chorioamnionitis was noted in our study group. We detected two pregnancies that experienced ablatio placenta in the PPROM group.

Table 1: Demographic and clinical characteristics of pregnancies complicated with PROM in comparison to pregnancies complicated with PPRM.

Characteristics	<37 week (n=85)	≥37 week ( n=249)	Z, p
Maternal age	31(6)	28 (11)	0.414, 0.686
Gravida	1(2)	1(1)	0.617, 0.537
Parity	1(1)	1(1)	0.108, 0.914
Effacement	60(10)	60(10)	1.793,0.073
Dilatation	2 (2 )	2 (1)	4570, <b>0.001</b>
HOP (%)	1(1.2)	10 (4)	0.674, 0.501
Twin (%)	13 (15.3)	0	*39.625, <b>&lt;0.001</b>
GDM (%)	1(1.2)	6(2.4)	*0.47, 0.493
GDM+poly(%)	3(3.5)	2(0.8)	*3.194, 0.073
Polihydramnios(%)	3(3.5)	13(5.2)	*0.398, 0.528
Valsalva (%)	8(9.4)	53(21.3)	3.726, <b>&lt;0.001</b>
Leukocyte(x1000)	13.7 (7.2)	12.4 (6.100)	0.070, 0.945
CRP	14.0 (13.0)	15.0 (10.0)	0.070,0.945
Latency	1.0(0.5)	0.5(0.0)	5445, <b>&lt;0.001</b>
Delivery (svd/cs)	41/ 44	178/71	5247, <b>&lt;0.001</b>
Sex (male/female)	45/53	120/129	0.587, 0.557
Fetal weight	2588.3 (539.5)	3553.4 (3153.1)	9.831, <b>&lt;0.001</b>
AFI	13 (1)	11 (4)	1626, 0.113
APGAR	9 (0)	10(0)	2697, <b>0.007</b>
ANICU(%)	60 (61.2)	38 (15.3)	8.266, <b>&lt;0.001</b>
TNICU	5.3 (6.3)	1.9 (1.6)	3267, <b>0.001</b>
Maternal fever	0	0	0.000, 1000

Z: Mann-Whitney U testi \*:Pearson X<sup>2</sup> **Valsalva**: Leakage from the cervical os with coughing or fundal pressure, **HOP**: History of PPRM **ANICU**: Admission to neonatal intensive care unit (NICU), **LNICU**: Length of hospitalization at the NICU

Table 2: Clinical characteristics of pregnancies complicated with PPRM in subgroups. (&lt;34, and ≥34 gestational ages)

Characteristics	<34 weeks (n=17)	34-37 weeks (n=68)	Z, p
Age*	27(23-38)	30(20-40)	1843,0.065
Gravida*	1(1-4)	1(1-10)	0.482,0.630
Dilatation*	2(1-9)	2(1-4)	0.104, 0.917
Valsalva (%)	10(58.8)	42(61.8)	0.520,0.603
CRP*	31(23)	15(8)	0.178,0.206
Leukocytes (x1000)*	23.4(9.3)	15.3(5.6)	1.710,0.087
Urinary infection	4	9	1112,0.291
Vaginitis	3	13	0.019,0.889
Twin (%)	9(52.9)	4(5.8)	23248, <b>&lt;0.001</b>
Latency (range, hrs)*	48 ( 20-192)	19(5-36)	3848, <b>&lt;0.001</b>
Delivery type (svy/cs)	2/15	37/ 31	3503, <b>&lt;0.001</b>
<b>Newborns</b>	<b>n=26</b>	<b>n=72</b>	<b>p</b>
Fetal weight (IQR)	2000(460)	2733(415)	<b>&lt;0.001</b>
SGA*	4 ( )	5 ( )	0.201
LGA*	2( )	11 ( )	0.328
ANICU (%)	24 (94.1)	38 (52.9)	<b>0.002</b>
LNICU	10(17)	2(3)	<b>&lt;0.001</b>
RDS-TTN*	12(9.5)	6(3.1)	<b>&lt;0.001</b>
Sepsis-Pneumonia*	9(9.5)	4(2.0)	<b>&lt;0.001</b>
Jaundice*	7(22.6)	12(3.1)	0.256
Neonatal death*	2(2.1)	0	0.068

\* X<sup>2</sup> test, Z: Mann-Whitney U test

The frequency of GDM and/or polyhydramnios were more common in the 34-37 weeks subgroups, but twin pregnancy ( $p<0.001$ ) was more common in the younger subgroup of PPROM (Figure 1).

Figure 2 showed that the proportion of CS in the younger PPROM group (<34) was significantly higher than the proportion of vaginal delivery ( $p<0.001$ ). In this group, major indication of CS delivery was twin pregnancy. In the 34-37 week subgroup 54% of patients were delivered by vaginally. In this subgroup main CS indications were fetal distress and repeated cesareans.

Figure 1: Detected prenatal complications A.<34 gestational weeks. B. 34-37 gestational weeks

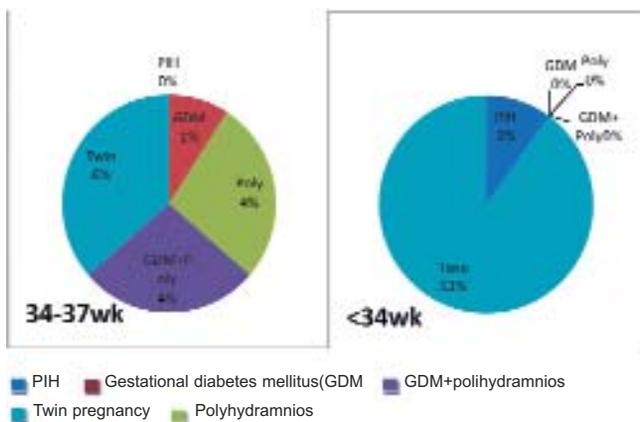


Figure 2: Delivery type and indicesarean section indications in PPROM subgroups

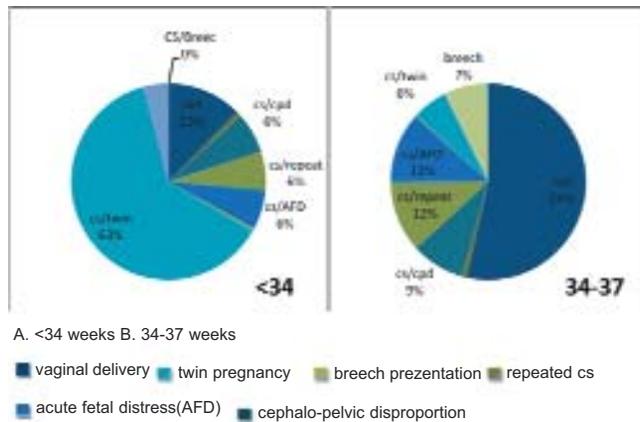


Table 1 showed that 38 (15%) of 249 infants from the PROM group were admitted to the hospital’s NICU during that time ( $p<0.001$ ). The median (IQR) length of stay in the NICU were 5.3 (6.3) and 1.9 (1.6) days ( $p=0.001$ ) for PPROM and PROM groups. Table 2 displays frequency of admission to NICU was significantly higher in the newborns of <34 weeks subgroup compared to 34-37 weeks ( $p=0.002$ ). The median (IQR) length of stay in the NICU were 10<sup>17</sup> days for newborns of the PPROM pregnancies smaller than 34 weeks and 2<sup>3</sup> days for newborns of the 34-37 weeks subgroup ( $p<0.001$ ). Table 2

showed that the diagnoses of infants that were admitted to the NICU were also significantly different between subgroups of PPROM ( $<0.001$ ). Newborns from the <34weeks’ gestation group were significantly more likely to develop RDS and infectious problems (sepsis, pneumonia) than those who were delivered at 34-37 weeks of gestation ( $p<0.001$ ). No stillbirth deliveries occurred in our study group, but there were 2 neonatal death occurred in the PPROM group.

Table 3 showed Spearman’s correlation analysis using parameters for the PROM revealed that latency was negatively correlated with gestational weeks of pregnancy, cervical dilatation, positive valsalva sign upon admission, and presence of prenatal complications. We detected positive correlation between latency and necessity of admission to NICU and length of stay in the NICU in our study group.

Table 3: Correlation coefficients determined by simple correlation between the latency period and other clinical factors possibly affecting the latency.

Variables	Correlation coefficient (Rho)	p
Gestational age	<b>-0.488</b>	<b>&lt;0.001</b>
Maternal age	0.005	0.931
Gravida	0.013	0.811
Dilatation	<b>-0.163</b>	<b>0.003</b>
Valsalva	<b>-0.148</b>	<b>0.055</b>
Leukocytes	0.092	0.093
CRP	0.014	0.918
High risk pregnancy	<b>0.377</b>	<b>0.014</b>
Delivery type	<b>0.277</b>	<b>&lt;0.001</b>
ANICU	<b>0.144</b>	<b>0.009</b>
TNICU	<b>0.278</b>	<b>0.008</b>

### Discussion

Our study provides information on clinical factors associated with preterm rupture of the membranes in a private tertiary referral hospital in the Ankara. Relatively homogeneous patient population and its setting in a obstetrics department with unified management guidelines are the advantages of the study.

In the present study, we have shown that, pregnancies of the PROM group had increased cervical dilatation and easily confirmed fluid passage through the cervix with valsalva at the admission, their latency period was shortened, they had low CS delivery rate and well fetal outcome compared to the PPROM group. These findings provide support for the opinions that PROM occurs as a result of a physiologic, and progressive membrane weakening, which is a normal component of the process of labor.<sup>1</sup> Presence of long latency, subtle cervical-vaginal findings at the admission, high CS delivery ratio, and worse fetal outcome in the PPROM group may also linked

to several causes of pathologic weakening of the fetal membranes.<sup>1,5</sup> Moreover, our data confirm that the time between rupture of the membranes and the delivery was significantly longer among women with PPRM before 34 weeks in comparison to PPRM after 34 weeks' gestation. In concordance with previous studies, our findings noted that perinatal morbidity was inversely associated with both gestational weeks of the pregnancy and the latency.<sup>6,7</sup>

According to the results of this study, twin pregnancy was linked to the occurrence of PROM before 34 week but GDM and/or polyhydramnios were seen in the etiology after 34 weeks' gestational age. These are major causes of uterine over distention in pregnancy. As declared by Merker and colleagues, twin pregnancy was main risk factor for PPRM in our 24-34 weeks' subgroup.<sup>8</sup> However, most cases of PROM and PPRM occur in women without identifiable risk factors.

Our study also showed that, the earlier in gestation that PROM occurs, the greater is the rate of CS delivery. In PPRM pregnancies, twin pregnancy was the major indication of CS delivery before 34 weeks, repeated cesareans and acute fetal distress were major indications in the 34-37 week subgroup. The brief latency period between membrane rupture and delivery makes predisposition for acute perinatal complications; infection, ablasyo placenta, cord compression and fetal hypoxia.<sup>9,1</sup> Pregnancies complicated with PPRM and smaller than 37 weeks' gestation have risk for umbilical cord compression and high incidence of variable decelerations detected during fetal monitoring.<sup>10</sup> Therefore, acute fetal distress is the leading indication for cesarean in this group.

Our study showed that infants of PPRM pregnancies delivered before 34 weeks' gestation were associated with higher infectious neonatal problems, such as sepsis and pneumonia, compared to 34-37 weeks' group. The newborns of this group were smaller and the need and duration of NICU admission were higher in newborns of this group. Tanır et al. compared preterm deliveries with and without PPRM before 34 weeks of gestation.<sup>11</sup> They were unable to find any differences in neonatal mortality between the groups and concluded that 'Neonatal outcome was mainly affected by prematurity rather than by PPRM.' Conversely, Furman et al. examined neonatal and maternal birth outcomes in same preterm delivery types between 24-32 gestational weeks<sup>12</sup> and found that PROM was associated with a significantly lower gestational age and birth weight compared to those with intact membranes. The rates of chorioamnionitis, urinary infection, endometritis, bacteremia in the postpartum period, and perinatal mortality rates were significantly higher in women with PPRM compared with controls. They concluded that infectious morbidity is an important risk factor for obstetrical and neonatal complications in patients with PPRM.

In conclusion, this study showed that pregnancies of the PROM(>37) group had increased cervical dilatation, shortened latency period, low CS delivery rate and well fetal outcome compared to the PPRM group. These findings provide support for the opinions that PROM is a normal component of the process of labor. On the other hand, pregnancies complicated with PPRM before 34 weeks' had long latency, subtle cervical-vaginal findings at the admission, high CS delivery ratio, and worse fetal outcome. These findings considered, premature PROM is a result of pathologic weakening of the fetal membranes. The time between admission and delivery was inversely associated with gestational weeks of the pregnancy in the PPRM group, so infectious morbidity during the neonatal period was more prevalent in the newborns of this group.

### Özel Üçüncü Düzey Bir Referans Hastanesinde Otuzdördüncü Gebelik Haftasından Önce ve Sonra Oluşan Erken Membran Rüptürü Olgularında Gebelik Sonuçları

**AMAÇ:** Gebeliğin 34. haftasından önce ve sonra gelişen erken membran rüptürü olgularının sonuçlarının araştırılması.

**GEREÇ VE YÖNTEM:** 2007-2010 yılları arasında 85 PPRM (preterm erken membran rüptürü) ve 249 PROM (erken membran rüptürü) olgusunu içeren retrospektif bir çalışma yapıldı. Veriler ki-kare, Mann-Whitney testi ve Spearman korelasyon analizi ile değerlendirildi.

**BULGULAR:** 34 hafta öncesinde ikiz gebelik, sonrasında ise GDM ve/veya polihidramniyoz etyolojide sık görüldü. Membranların yırtılması ile fetusun doğumu arasında geçen latent süre 34 haftadan küçük gebeliklerde daha uzundu ( $p<0.001$ ). Bu grubun bebeklerinde yenidoğan yoğun bakım ihtiyacı ve orada kalış süresi daha fazla bulundu ( $p<0.001$ ). Bu yenidoğanlarda, 34-37 hafta grubunun yenidoğanlarına oranla sepsis ve pnömoni gibi enfeksiyöz neonatal sorunlar sıklığı ( $p<0.001$ ).

**SONUÇ:** 34 haftadan önceki PPRM, daha uzun bir latent süreye sahiptir ve yenidoğanda daha fazla enfeksiyöz morbidite ve mortaliteye yol açmaktadır.

**Anahtar Kelimeler:** Erken doğum, Preterm erken membran rüptürü, Prematürite, Amniyotik sıvı

### References

1. Mercer BM. Premature Rupture of the Membranes. In: Creasy RK, Rednik R, Iams JD, Lockeod CJ, Moore TR, editors. Creasy&Resnik's Maternal-Fetal Medicine. 6th ed. Philadelphia: Saunders Elsevier; 2009. P. 599-612.
2. Caughey AB, Robinson JN, Norwitz ER. Contemporary diagnosis and management of preterm premature rupture of membranes. Rev Obstet Gynecol 2008;1:11-22.
3. Cousens S, Blencowe H, Gravett M, Lawn JE. Antibiotics

- for pre-term pre-labour rupture of membranes: prevention of neonatal deaths due to complications of pre-term birth and infection. *Int J Epidemiol.* 2010;39:134-43.
4. Cande V, Ananth, Anthony M, Vintzileos. Epidemiology of preterm birth and its clinical subtypes. *Journal of Maternal-Fetal and Neonatal Medicine* 2006;19:773-82.
  5. ACOG Practice Bulletin. Premature Rupture of Membranes. *Obstet Gynecol* 2007;109:1007-18.
  6. Test G, Levy A, Wiznitzer A, Mazor M, Holcberg G, Zlotnik A, Sheiner E. Factors affecting the latency period in patients with preterm premature rupture of membranes. *Arch Gynecol Obstet* DOI 10.1007/s00404-010-1448-7, 2010 Mar 20.
  7. Melamed N, Hadar E, Ben-Haroush A, Kaplan B, Yogev Y. Factors affecting the duration of the latency period in preterm premature rupture of membranes. *J Matern Fetal Neonatal Med* 2009;22(11):1051-6
  8. Mercer BM, Crocker LG, Pierce WF, Sibai BM. Clinical characteristics and outcome of twin gestation complicated by preterm premature rupture of the membranes. *Am J Obstet Gynecol.* 1993;168:1467-73.
  9. Cox SM, Leveno KJ. Intentional delivery versus expectant management with preterm ruptured membranes at 30-34 weeks' gestation. *Obstet Gynecol.* 1995;86:875-9.
  10. Mercer BM, Crocker LG, Boe NM, Sibai BM. Induction versus expectant management in premature rupture of the membranes with mature amniotic fluid at 32 to 36 weeks: a randomized trial. *Am J Obstet Gynecol* 1993;169:775-82.
  11. Tanir HM, Sener T, Tekin N, Aksit A, Ardic N. Preterm premature rupture of membranes and neonatal outcome prior to 34 weeks of gestation. *Int J Gynaecol Obstet.* 2003 ;82:167-72.
  12. Furman B, Shoham-Vardi I, Bashiri A, Erez O, Mazor M. Clinical significance and outcome of preterm prelabor rupture of membranes: population-based study. *Eur J Obstet Gynecol Reprod Biol.* 2000; 92:209-16.