



## The influence of prolonged preterm premature rupture of the membranes on neonatal outcome of the presenting and non-presenting twin



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### ABSTRACT

**Objective:** To compare the neonatal outcome in twin gestations complicated by prolonged preterm premature rupture of membranes (PPROM).

**Study design:** Between the years 2000 and 2010 we identified 48 women with twin pregnancies who were diagnosed as having PPRM and a latency period to delivery >24 h. We compared the neonatal morbidity and mortality between the presenting and non-presenting twins, assuming that the rupture occurred in the lower sac. Importantly, in 30 women we were able to identify the location of the ruptured sac by ultrasound examination demonstrating oligohydramnion. In these 30 cases, neonatal outcome of fetuses in the ruptured sac and those in the intact sac were compared.

**Results:** The median gestational age was 31 weeks (range 28–33) with a median latency period between PPRM and delivery of 9 days (range 1–18).

Of the identified ruptures 90% (27/30) occurred in the lower sac (presenting twin). There was no significant difference between the presenting and non-presenting twin in terms of neonatal morbidity and mortality. Moreover, no difference was found when fetuses with ruptured sac were compared to those with intact membrane sac. Importantly, the outcomes were not affected by the length of the latency period.

**Conclusion:** The current study results demonstrated that the outcome of fetuses exposed to prolonged preterm rupture of membranes is similar to that of fetuses with intact membranes. Our data suggest that rupture of membranes per se did not cause any deleterious clinical manifestations or lead to clinical discordant inflammation and poor neonatal outcome, supporting a conservative management of twin pregnancies with PPRM.

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### Introduction

Twin pregnancies are becoming increasingly more common worldwide with a rate of 32.6/1000 in the United States in 2008. Preterm deliveries, the leading cause of perinatal morbidity and mortality, occur in 60% of twin deliveries [1]. Preterm premature rupture of the membranes (PPROM) occurs in 7–8% of twin pregnancies with a mean gestational age of 30–32 weeks [2]. In twin pregnancies with PPRM, prematurity is the primary cause of neonatal complications, which include respiratory distress syndrome, necrotizing enterocolitis and sepsis [3]. Intrauterine infection has been implicated as both the cause and the result

of pregnancies complicated by PPRM [4]. An important consideration in cases of PPRM in twin pregnancies is the different milieu in which the fetuses are found because one of the amniotic sacs had broken. The result may be manifest in discordant inflammation, especially when the latency period between rupture of the sac and delivery is prolonged. Moreover, the occurrence of advanced inflammation was reported as being significantly higher in the presenting twin in dichorionic placentae when histologically confirmed chorioamnionitis and funisitis were compared between presenting and non-presenting fetuses [5]. Current recommendations in cases of twin pregnancies complicated by PPRM include: antibiotic treatment, antenatal steroids and delivery no later than 34 weeks of gestation [6]. Earlier studies that compared the obstetric outcome between singleton and twin pregnancies with PPRM reported that the latency period for twin pregnancies was shorter than that of singleton pregnancies (the average latency duration was ≤48 h in 50–90% of PPRM pregnancies), but that

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there was no difference in neonatal outcome [2,7,8]. The aim of our study was to compare the neonatal outcome of fetuses in twin pregnancies complicated by PPROM at  $\leq 34$  weeks of gestation and characterized as having a latency period of  $\geq 24$  h between sac rupture and delivery.

## Materials and methods

We conducted this retrospective cohort study at a tertiary university-affiliated medical center. The institutional review board approved the study design, protocol and waiver of informed consent. Medical records of all women with a twin pregnancy who delivered in our institution between 2000 and 2010 were reviewed. Women who were diagnosed as having PPROM at  $\geq 20$  weeks of pregnancy and who delivered at  $>24$  and  $<34$  weeks of gestation with a latency period  $\geq 24$  h were included. A detailed sonographic evaluation that included amniotic fluid measurement was performed on all the study women during their hospitalization. The diagnosis of PPROM was made by the attending physician according to the patient's history and physical examination findings, such as pooling of amniotic fluid, a positive Nitrazine test and oligohydramnios demonstrated on ultrasound. All patients received broad-spectrum antibiotics and steroids upon admission according to the accepted guidelines [6]. The study women were managed expectantly until 34 weeks of gestation unless there were signs of either fetal or maternal compromise. Chorioamnionitis was defined as maternal fever  $>38.0^\circ\text{C}$  and at least one of the following criteria: uterine tenderness, maternal leukocytosis  $>18,000$ , maternal tachycardia  $>100$  bpm, fetal tachycardia  $>160$  bpm or foul smelling vaginal discharge without evidence of any other source of infection. The retrieved data included demographic variables (maternal age and parity), intrapartum variables (estimated gestational age, latency period, gender, fetal weight, mode of delivery) and postpartum neonatal outcome (neonatal mortality, 1- and 5-min Apgar scores, hospitalization period, respiratory support, phototherapy, hypotension, respiratory distress syndrome, surfactant therapy, apnea, intraventricular hemorrhage, periventricular leukomalacia, sepsis, necrotizing enterocolitis, hypoglycemia, electrolyte disturbances [including hyponatremia, neonatal anemia, thrombocytopenia], and usage of blood products. Women were excluded from the study if any of the following criteria were present: delivery at  $<24/0$  weeks of gestation, latency period  $<24$  h, major anomalies, presence of intrauterine growth restriction or discordancy.

Our primary purpose was to compare the neonatal outcome of fetuses within an intact sac to those within the ruptured sac. We first compared the presenting and the non-presenting twins, assuming that membrane rupture occurred almost exclusively in the lower sac [9]. In 30 women we were able to identify the location of the ruptured sac by ultrasound examination, which have shown oligohydramnion (amniotic fluid index  $<5$  or maximal sac  $<2$ ). The neonatal outcome of the two fetuses in these 30 cases were compared as well.

The statistical analysis was carried out using SAS for windows version 9.2. The comparison of neonatal outcomes between the two groups was done with three types of tests. Binary outcomes were compared using the McNemar test for symmetry. Continuous variables that do not follow a normal distribution were compared by Wilcoxon signed-rank non parametric test and continuous variables that follow normal distribution were compared by paired *t*-test.

## Results

Between 2000 and 2010, one thousand eight hundred and eleven twin pregnancies delivered in our tertiary care institution.

**Table 1**

Demographic and clinical characteristics of 48 women with premature rupture of membranes.

Characteristic	Value
Age (y)	34.93 $\pm$ 2.31
Gravidity, (N)	2.31 $\pm$ 1.60
Parity (N)	0.6 $\pm$ 0.89
Gestational age at delivery (wk)	31 (28–33)
Mode of delivery	
Cesarean section (%)	39 (81.2)
Vaginal (%)	9 (18.7)
Latency period (h)	9 (4–18)

Data are presented as mean  $\pm$  standard deviation, median (range) or absolute numbers (percentage).

Of these, forty-eight twin deliveries met the inclusion criteria for the current study. Forty-seven women had dichorionic-diamniotic pregnancy while only one woman had monochorionic-diamniotic pregnancy. Demographic data and obstetric information of these women are presented in Table 1. The median gestational age at delivery was 31 weeks (range 28–33) with a median latency period of 9 days (range 4–19). Thirty-five women (73%) delivered following spontaneous onset of labor, six were delivered due to suspected chorioamnionitis (12.5%), two due to suspected fetal distress, and one due to suspected placental abruption. Four women were electively delivered when they reached 34 weeks of gestation. The results of the comparisons of neonatal outcomes between the presenting and non-presenting twins are shown in Table 2. There was no difference in birth weight between the two groups (1467  $\pm$  461 g vs. 1493  $\pm$  417 g, respectively,  $P = 0.4$ ). The rate of both respiratory support and mechanical ventilation support were similar between the presenting and non-presenting twins (66% vs. 64%,  $P = 0.7$ , and 39% vs. 37%,  $P = 0.7$ , respectively). Moreover, there were no group differences in the rate of respiratory distress syndrome, surfactant treatment or any other neonatal morbidities, such as necrotizing enterocolitis, hypoglycemia, bronchopulmonary dysplasia, hyponatremia, hypotension, intraventricular hemorrhage, periventricular leukomalacia, blood transfusion requirement, and administration of phototherapy. There was one case of fetal mortality in each group in two different women (one case in the PPROM group at 29 weeks of gestation due to severe ischemic brain damage, a second case in the intact membrane group due to respiratory failure at 27 weeks of gestation). The rate of sepsis was similar for both the

**Table 2**

Comparison of perinatal outcome between presenting and non-presenting twins.

Characteristic	Presenting twin <i>n</i> = 48	Non-presenting twin <i>n</i> = 48	<i>P</i>
Fetal weight	1467 $\pm$ 461	1493 $\pm$ 417	0.4
APGAR 1 min	7.22 $\pm$ 2.14	7.06 $\pm$ 1.97	0.5
APGAR 5 min	8.7 $\pm$ 1.32	8.6 $\pm$ 1.62	0.8
Respiratory distress syndrome (%)	21 (43)	21 (43)	1
Bronchopulmonary dysplasia	5 (10.4)	7 (14.5)	0.4
Respiratory support (%)	32 (66.6)	31 (64.5)	0.7
Mechanical ventilation support (%)	19 (39.5)	18 (37.5)	0.7
Apnea (%)	29 (60.4)	26 (54.1)	0.08
Jaundice requiring phototherapy (%)	31 (64.5)	27 (56.2)	0.3
Necrotizing enterocolitis (%)	3 (6.2)	1 (2.0)	0.3
Periventricular leukomalacia (%)	1 (2.0)	3 (6.2)	0.3
Intraventricular hemorrhage (%)	11 (22.9)	7 (14.5)	0.2
Hypoglycemia	6 (12.5)	6 (12.5)	1
Thrombocytopenia	4 (8.3)	1 (2.0)	0.08
Hyponatremia	3 (6.2)	4 (8.3)	0.6
Anemia requiring blood transfusion	10 (20.8)	7 (14.5)	0.08
Sepsis (%)	9 (18.7)	7 (14.5)	0.43
Mortality (%)	1 (2)	1 (2)	1

Data are presented as mean  $\pm$  standard deviation or absolute number (percentage).

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