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Obstetric management and neonatal outcomes of single fetal previable preterm premature rupture of membranes (PV-PPROM) in dichorionic twin pregnancy: A case series

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Abstract

Objective: This study aimed to assess the maternal and neonatal outcomes associated with various obstetric management strategies in dichorionic twin pregnancies following fetal previable preterm premature rupture of membranes (PV-PPROM), in instances where the pregnancy is continued.

Methods: In this case series, seven pregnancies involving dichorionic twins admitted with PV-PPROM before 23+6 weeks of gestational age were included, totaling 14 fetuses. The assessed parameters included demographic details, PPROM onset time, delivery time, duration of the latent period, cervical length upon hospitalization post-PPROM, cervical dilatation, white blood cell (WBC) count (10^3/µL), C-reactive protein (CRP) levels (mg/L), obstetric examination findings, chosen obstetric management, outpatient follow-up, mode of delivery, neonatal mortality, APGAR score, cord pH, birth weight, and neonatal intensive care requirements.

Results: The study encompassed seven pregnant individuals and 14 fetuses. The average maternal age was 31.2 years (range 24–43 years), with 57% of pregnancies being dichorionic twins resulting from in vitro fertilization. The mean gestational week at the time of PPROM was 16.8 weeks (ranging from 13 to 19+3). Among the cases studied, expectant management was employed in three cases, selective fetal reduction in two cases, and delayed-interval delivery in two cases. Neonatal outcomes revealed a 35% rate of live births and a 21% neonatal survival rate without significant morbidity.

Conclusion: Managing obstetric care poses challenges following single fetal PV-PPROM in dichorionic pregnancies. Obstetric management should be personalised by evaluating the intrauterine localization of the fetus with PPROM, considering cervical examination findings, and taking into account chorioamnionitis findings. It is essential to engage in discussions with parents about potential risks and complications.

Keywords: PPROM, twin pregnancy, selective fetal reduction, delayed interval delivery

Introduction

In twin pregnancies, 7.4% are affected by preterm premature rupture of membranes (PPROM), a complication that occurs more frequently than in singleton pregnancies.[1] The life threshold in singleton pregnancies with PPROM has been established at 1000 cases, with a rate of 4. The management of singleton pregnancies highlights fetal, maternal, and neonatal complications such as chorioamnionitis, fetal loss, fetal lung hypoplasia, and extreme preterm birth.[2] The management of twin pregnancies following PPROM in a single fetus poses considerable challenges, particularly during the previable period. These challenges stem from the complexities associated with ensuring the survival of the unaffected twin; the potential for severe neonatal complications, such as lung hypoplasia in the fetus experiencing anhydramnios due to pre-viable PPROM; and the intricacies of maintaining a balance in maternal complications. In the event of pre-viable PV-PPROM occurring in twin pregnancies, the option of terminating the pregnancy may be presented to the family, especially if they do not wish for the pregnancy to continue or do not accept maternal morbidities. For parents desiring the continuation of the pregnancy, various options can be assessed.

One of the obstetric management options following the diagnosis of PV-PPROM in dichorionic twin preg-

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nancies is selective fetal reduction through intracardiac injection of potassium chloride (KCL).[3] Studies have demonstrated that the duration until delivery is extended, and neonatal outcomes are more favorable in cases where selective fetal reduction is performed compared to those undergoing expectant management.[3,4]

Another obstetric management option is delayed-interval delivery, particularly in cases of PPROM with cervical dilation. Certain studies have indicated an improvement in neonatal survival rates in pregnancies with multiple chorions when this approach is employed.[5] Furthermore, the follow-up of pregnant women undergoing delayed-interval delivery can be supplemented with interventions such as cerclage, prophylactic antibiotics, and tocolysis treatments.[6]

Another obstetric management option is expectant management. It is important to note that neonatal mortality and morbidity rates are high for patients undergoing expectant management following PV-PPROM, and this approach may lead to maternal chorioamnionitis. In one study, it was reported that only 17% of cases of PPROM occurring before 26 gestational weeks in multiple pregnancies survived without significant neonatal morbidity.[7]

This study was conducted to assess the maternal and neonatal outcomes associated with various obstetric management approaches in dichorionic twin pregnancies following PV-PPROM in one fetus occurring before 23+6 weeks of gestation, in the event of continued pregnancy.

Methods

This case series was conducted at a tertiary centre, and ethical approval (numbered 2686) was obtained from the local ethics committee.

Dichorionic twin pregnancies admitted to the ward because of PPROM before 23+6 weeks of gestational age between January 2022 and July 2023 were systematically screened. Inclusion criteria comprised the family's expressed willingness to continue the pregnancy, refusal of the option to terminate the pregnancy, comprehensive information provided to the family regarding potential complications, and complete adherence to the chosen form of obstetric management. Additionally, confirmation of the dichorionic pregnancy diagnosis and verification of the PPROM diagnosis in a single fetus were established either through the Amni-Sure test (Amni-Sure, Germantown, MD) or vaginal examination. The entire process of pregnancy monitoring and delivery took place within the same hospital. Exclusion criteria encompassed cases with unknown chorionicity, unconfirmed PPROM, the presence of fetal anomalies incompatible with viable life, maternal clinical signs of chorioamnionitis, incomplete patient compliance with pregnancy follow-up, delivery occurring in a different hospital, and unavailability of neonatal information.

The demographic and characteristic parameters examined included maternal age, gravida, parity, the use of assisted reproductive techniques, gestational weeks at the time of PPROM, delivery weeks of gestation, and the duration of the latent period. Obstetric examination findings that were assessed comprised obstetric management, laboratory parameters, and neonatal outcomes (Table1.). Specifically, cervical length, the extent of cervical dilatation determined through vaginal examination, white blood cell (WBC) count (expressed as 10^3/μL), and C-reactive protein (CRP) levels (measured in mg/L) were evaluated upon hospitalization following PV-PPROM. The positioning of the fetus in cases of diagnosed PPROM was classified as either 'lower placement' when in contact with the internal os or 'upper placement' when unrelated to the internal os. Additionally, the chosen obstetric management, outpatient follow-up and obstetric examination findings, neonatal mortality, birth weight, gender, umbilical artery pH, APGAR score, neonatal examination findings, and neonatal intensive care requirements were all subject to evaluation (Table 2.). Data were presented as mean ± standard deviation (SD) for continuous variables, whereas frequencies (n) with percentages (%) were used for categorical data.

Table 1. Demographic parameters, characteristic parameters and obstetric outcomes

Patient	Obstetric management	Maternal Age (years)	Gravida	Reproductive techniques	Gestational week at PPROM	Vaginal examination on the day of PPROM	The intrauterine positioning of the fetus diagnosed with PPROM	Gestational week at delivery	Latent period between PPROM and delivery (days)
1	Expectant management	43	2	-	13	Cervical length 35 mm, no dilation	Upper/left	16	23
2	Delayed-interval delivery and cervical cerclage application	32	1	IVF	16+3	Cervical length 5 mm, 1-2 cm dilation	Lower/left	21+2	34

3	Selective fetal reduction	32	2	-	15+1	Cervical length 37 mm, no dilation	Upper/right	38	161
4	Delayed-interval delivery	26	2	IVF	17+4	Cervical length 15 mm, 1-2 cm dilation	Lower/left	36+4	133
5	Selective fetal reduction	36	2	-	19+3	Cervical length 32 mm, no dilation	Upper/left	38	130
6	Expectant management	26	2	IVF	18+5	Cervical length 26 mm, no dilation	Lower/left	23+1	26
7	Expectant management	24	1	IVF +ovum donation	17+2	Cervical length 16 mm, 1-2 cm dilation	Upper/right	17+5	3

Table 2. Obstetric management and neonatal outcomes

Patient	Obstetric management	Pregnancy outcomes	Birth weight (g)	APGAR score 1/5 minute	Cord pH	Neonatal outcomes
1	Expectant management	Abortus	-	-	-	-
2	Delayed-interval delivery and cervical cerclage application	Pregnancy of termination	-	-	-	-
3	Selective fetal reduction	Single survival	3325	9/10	7.31	Healty
4	Delayed-interval delivery	Single survival	2800	9/10	7.45	Healty
5	Selective fetal reduction	Single survival	3115	9/10	7.41	Healty
6	Expectant management	Extreme preterm birth, both babies died in the postpartum period	532/518	Intubate/ intubate	7.28/7.31	Postpartum died
7	Expectant management	Abortus	-	-	-	-

Results

A total of seven pregnant individuals who accounted for 14 fetuses and met the inclusion criteria were enrolled in the study. The mean maternal age was 31.2 years, ranging from 24 to 43 years. Notably, 57% of the pregnancies were dichorionic twin pregnancies resulting from in vitro fertilization. The average gestational age at the time of PPROM was 16.8 weeks, falling within the range of 13 to 19+3 weeks. Among the included cases, three involved expectant management, two underwent selective fetal reduction, and two opted for delayed-interval delivery. The neonatal outcomes observed were as follows: 35% of the cases resulted in live births, and 21% demonstrated neonatal survival without significant morbidity.

Case 1: A 43-year-old woman, gravida 2, para 1, at 13 weeks of gestation with dichorionic-spontaneous twins, based on her last menstrual period, presented to the emergency room reporting fluid leakage. The obstetric examination revealed 13/13+1 compatible dichorionic live twin fetuses based on crown-rump length (CRL). Anhydramnios was observed in the ultrasound examination of the fetus located on the upper left side. The Amni-Sure test confirmed the rupture of membranes. The cervical length was 35 mm and closed. CRP value was <5 mg/L, and the WBC count was 8.3×103/μL. Antibiotic prophylaxis was administered for PPROM. Expectant management was chosen because the family declined medical intervention options.

At the 16th gestational week, the patient presented with bleeding. Vaginal examination revealed a 2-cm cervical dilatation, and the cervical length was 10 mm. The CRP value was <5 mg/L and the WBC count was 12.5×10^3/μL. During hospitalization, on the second day, the pregnant woman spontaneously aborted both fetuses.

Case 2: A 32-year-old primigravida, at 16+3 weeks gestation with dichorionic in vitro fertilization (IVF) twins, presented to the hospital with complaints of fluid leakage and vaginal bleeding. The obstetric examination revealed dichorionic live twin fetuses at 16+3/17 weeks based on biparietal diameter (BPD). Severe oligohydramnios (the deepest single pocket was 1 cm) was detected in the ultrasound examination of the fetus located on the lower left side. Vaginal examination indicated 1–2 cm dilatation with amniotic fluid leakage and a cervical length of 5 mm. Laboratory parameters showed CRP at 18 mg/L and WBC at 13.2×10^3/μL. No signs of chorioamnionitis were observed on physical examination. Antibiotic prophylaxis was administered for PPROM.

On the second day of hospitalization, the fetus with PPROM in the lower left side spontaneously aborted. The cord was cut at the shortest part and tied, leaving the

placenta. The delayed interval delivery option was chosen. Vaginal examination revealed a closed cervix of 27 mm. Following antibiotic prophylaxis for PPROM, the CRP value was <5 mg/L, the WBC value was 9.4×10^3/µL, and maternal chorioamnionitis findings were not detected. The patient was scheduled for weekly follow-ups and discharged.

At 19+4 gestational weeks, a cervical examination revealed a cervical length of 9 mm. Laboratory parameters showed a CRP value <5 mg/L, and WBC was 10.1×10^3/µL. A vaginal culture test was negative. An emergency cervical cerclage procedure was performed, and vaginal progesterone (200 mg) OD was initiated. In weekly follow-ups, amniotic fluid leakage in the second fetus at 21+2 gestational weeks was confirmed by the Amni-Sure test. Evidence of anhydramnios was observed in the other intrauterine twin. The family was presented with the option of termination because of high maternal and fetal risks. The cerclage suture was removed, and the pregnancy was terminated.

Case 3: A 32-year-old woman, gravida 2, para 1, at 15+1 weeks gestation with dichorionic-spontaneous twins based on her last menstrual period, presented to the hospital with a complaint of fluid leakage. The obstetric examination revealed 15+3/15+4 weeks dichorionic intrauterine live twins based on BPD. The fetus located in the upper right position was diagnosed with anhydramnios, confirmed by a positive Amni-Sure test. The cervical length was 37 mm and closed. Laboratory parameters indicated a CRP value <5 mg/L and a WBC of 9.3×10^3/µL. Antibiotic prophylaxis was administered for PPROM, and selective fetal reduction was planned. On the second day of admission, the fetus located at the upper right side still exhibited anhydramnios, and fetal reduction was performed using intracardiac KCL with a 20-gauge needle. Cervical length remained >25 mm and closed during follow-up. At 38 weeks of gestation, a 3325 g female infant was delivered by cesarean section. The APGAR score was 9/10, and the umbilical cord pH value was 7.31. The newborn was discharged along with the mother.

Case 4: A 26-year-old gravida 2, para 0 woman, pregnant with dichorionic IVF twins, presented to the hospital at 17+4 weeks gestation with complaints of fluid leakage. Obstetric examination revealed 17+3/17+5 weeks dichorionic intrauterine live twin fetuses, as determined by BPD. The lower left-located fetus was diagnosed with anhydramnios, confirmed by a positive Amni-Sure test. Additionally, the cervical length measured 15 mm with a concurrent 1–2 cm dilatation.

Laboratory parameters exhibited an inflammatory response, with a CRP level of 35 mg/L and a WBC count of 14.3×10^3/µL, prompting the initiation of antibiotic prophylaxis for PPROM. On the third day of hospitalization, spontaneous abortion occurred in the lower left-located fetus with subsequent cord clamping at the shortest point and tying, while the placenta was intentionally retained. A delayed-interval delivery approach was subsequently planned.

Follow-up assessments of cervical length demonstrated a closed cervix measuring 32 mm following antibiotic prophylaxis for PPROM. Post-treatment CRP levels decreased to <5 mg/L, the WBC count normalised to 9.8×10^3/µL, and no signs of maternal chorioamnionitis were observed. Routine follow-up at 28 weeks gestation indicated a cervical length of 12 mm, a 1 cm dilatation of the cervical os, and negative results on the vaginal culture test. Vaginal progesterone was initiated at a daily dose of 200 mg. At the 34th week of gestation, a vaginal examination revealed a 3–4 cm dilatation of the cervix. Consequently, at 36+4 weeks of gestation, a 2800 g male infant was delivered via cesarean section because of non-vertex presentation. The APGAR score was 9/10, and the umbilical cord pH value was 7.45. Both the newborn and the mother were discharged in satisfactory condition.

Case 5: A 36-year-old gravida 2, para 1 woman, pregnant with dichorionic-spontaneous twins at 19+3 weeks gestation, presented to the hospital with a complaint of fluid leakage. Obstetric examination revealed dichorionic intrauterine live twin fetuses at 19+3/20+0 weeks gestation based on BPD. The lower right-located fetus exhibited normal amniotic fluid, but bilateral pes equinovarus (PEV) deformity was noted. Noninvasive prenatal testing (NIPT) in the first trimester indicated a low-risk result. The examination of the left upper fetus revealed anhydramnios, confirmed by a positive Amni-Sure test. The cervical length was 32 mm and closed. Laboratory parameters demonstrated a CRP level of <5 mg/L and a WBC count of 9.8×10^3/µL, leading to the administration of antibiotic prophylaxis for PPROM. The family received counseling regarding the potential complications and risks associated with the detected PEV deformity in the preserved twin. However, they declined further examination for the other twin, opting for selective fetal reduction of the upper right fetus with PPROM. On the second day of hospitalization, fetal reduction was performed on the upper right fetus using an intracardiac KCL injection with a 20-gauge needle. Following completion of antibiotic prophylaxis, the patient was discharged. Subsequent follow-up revealed no signs of chorioamnionitis, and the cervical length remained consistently >25 mm and closed. In the 38th week of gestation, a cesarean section was performed, resulting in the delivery of a 3115 g male infant.

The APGAR score was 9/10, and the umbilical cord pH value was 7.41. Both the mother and the newborn experienced no early complications. An orthopedic follow-up was planned to address the isolated PEV deformity.

Case 6: A 26-year-old gravida 2, para 0 woman, pregnant with dichorionic IVF twins at 18+5 weeks according to the last menstrual period, presented to the hospital with a complaint of fluid leakage. Obstetric examination revealed 19/19+1 dichorionic intrauterine live twin fetuses based on BPD. Anhydramnios was identified in the lower left-sided fetus, confirmed by a positive Amni-Sure test. The cervical length measured 26 mm and was closed. Laboratory findings indicated an elevated CRP level of 8.9 mg/L and a WBC count of 12.3×10^3/µL, leading to the administration of antibiotic prophylaxis for PPROM. Despite the family's refusal of medical interventions, chorioamnionitis findings were closely monitored. At 22+3 gestational weeks, the patient presented with bleeding. Vaginal examination revealed cervical dilatation of 2 cm and a shortened cervical length of 10 mm. Physical examination, however, did not reveal signs of chorioamnionitis. The CRP value increased to 42 mg/L, and the WBC count was 15.5×10^3/µL. On the fifth day after hospitalization, two live fetuses weighing 532 g and 518 g were delivered by vaginal delivery. Both infants were intubated, and the umbilical cord pH values were measured at 7.28/7.3. No early maternal complications developed; however, the infants, who were subsequently admitted to the neonatal intensive care unit, did not survive the postnatal period.

Case 7: A 24-year-old primigravida, pregnant with dichorionic in IVF twins at 17+2 weeks conceived through ovum donation to address premature ovarian failure, presented with a complaint of fluid leakage. Obstetric examination revealed dichorionic intrauterine live twin fetuses at 17/17+4 weeks gestation based on BDP. An anhydramnios sign was identified in the examination of the fetus located on the upper right side, confirmed by a positive Amni-Sure test. Cervical length measured 16 mm, and a 1–2 cm dilatation was observed. Laboratory parameters indicated an inflammatory response with a CRP value of 45 mg/L and a WBC count of 16.3×10^3/µL. Despite the absence of signs of chorioamnionitis on physical examination, antibiotic prophylaxis was administered for PPROM. Following the family's refusal of medical interventions, a follow-up plan was established. On the third day of hospitalization, both fetuses aborted spontaneously. Fortunately, no maternal complications arose from the incident.

Discussion

The management of dichorionic pregnancies poses a challenge, particularly in cases of PV-PPROM occurring in a single fetus before 23+6 weeks of gestational age. This case series highlights the crucial need for individualised obstetric management, taking into consideration factors such as the intrauterine location of the fetus with PPROM, cervical examination findings, presence of intrauterine infections, and signs of chorioamnionitis. Effective management involves thorough evaluation and discussion of potential risks and complications with the parents to make informed decisions regarding the course of care. The evidence presented suggests that cases involving selective fetal reduction exhibit an increase in the time until delivery and improved neonatal outcomes compared to expectant management.[4,3,8] In a twin pregnancy in which selective fetal reduction was performed because of PV-PPROM, the delivery of the remaining fetus was reported to occur close to term.[9] This led to the conclusion that neonatal outcomes might be more favorable compared to expectant management.

In this case series, the attainment of neonatal survival without significant morbidity was observed in only 21% of cases. Notably, it was intriguing that two of these neonates were part of the selective fetal reduction group. According to the neonatal outcomes of six fetuses from three pregnancies undergoing expectant management, only two fetuses were born alive, but both succumbed during the postnatal period due to extreme preterm delivery. Interestingly, two pregnancies managed expectantly exhibited similar features to those undergoing selective fetal reduction in terms of fetal positioning and cervical dilatation. When considering neonatal outcomes, it was noted that expectant management did not yield any healthy newborns, whereas selective fetal reduction resulted in the birth of two healthy infants.

The conclusion drawn was that delayed interval delivery might enhance neonatal outcomes for fetuses delivered later in dichorionic twin pregnancies.[10,11] The findings suggest that neonatal survival can be increased approximately fivefold compared to the first-born fetus.[12] Evidence indicates that emergency cerclage is beneficial in extending the gestation period in twin pregnancies undergoing delayed-interval delivery.[13] Furthermore, it has been emphasised that although delayed-interval delivery may decrease mortality in the remaining fetus, it is crucial to inform the family about neonatal morbidities associated with preterm delivery.[14]

In the follow-up of two pregnant women who underwent delayed-interval delivery in our case series, cervical failure was detected in both cases. One patient was

treated with vaginal progesterone, whereas the other underwent emergency cervical cerclage along with vaginal progesterone. The single surviving fetus without significant neonatal morbidity was part of the delayed interval delivery group. Indeed, a delay of 133 days was achieved, resulting in the delivery of a healthy newborn. However, this case necessitated close monitoring because of cervical failure starting from the 28th week of gestation. Vaginal progesterone treatment was initiated. In our second delayed-interval delivery case, cervical failure commenced much earlier in the pregnancy, prompting interventions such as cerclage and vaginal progesterone.

Among twin pregnancies undergoing expectant management because of PV-PPROM, only one pregnant woman reached the viability limits, but the neonates died in the neonatal period. In a large-scale study, it was reported that the latent period of twin pregnancies with a cervical length above 23 mm who underwent expectant management because of PV-PPROM was 37.5 days (18–67 days).[15] In a case report, a successful pregnancy outcome was documented in a dichorionic twin pregnancy in which PV-PPROM was detected in a single fetus at 13 weeks. The pregnancy was followed up as reduced amniotic fluid volume.[16] In the same report, emphasis was placed on the case-specific nature of this situation, cautioning against its generalization. It was underscored that individual cases should not be extrapolated universally. In our case series, the latent periods were 3, 23, and 26 days in twin pregnancies with adequate cervical length at the time of PPROM. The observed latent period was insufficient to progress towards further gestational weeks in pregnant women undergoing expectant management.

In pregnant women planned for expectant management, the option of delayed-interval delivery may be considered following the delivery of the fetus with PPROM at later gestational weeks. However, in our case series, both fetuses in three pregnant women who underwent expectant management were aborted. This outcome may be attributed to two factors. In two cases of expectant management, the fetus with PPROM was located distantly from the internal os, and the first fetus was healthy, resulting in the simultaneous abortion of both fetuses. Another potential explanation is the occurrence of subclinical chorioamnionitis during expectant management, leading to the simultaneous abortion of both fetuses due to strong contractions. Case 6 serves as an illustrative example of this scenario. Despite the lower location of the fetus with PPROM, the onset of uterine contractions and elevated C-reactive protein CRP may have precipitated the rapid delivery of both fetuses. In expectant management, PPROM poses a significant obstetric challenge, especially when coupled with the risk of fetal loss following cord prolapse. The occurrence of fetal loss after cord prolapse increases the risk of chorioamnionitis, which could impact the success of delayed-interval delivery or serve as a contraindication to it. In this case, dilatation and evacuation were considered to prolong the latent period.[17] The data regarding the continuation of pregnancy with PV-PPROM in dichorionic twin pregnancies remain limited and primarily exist at the level of individual cases because of the rarity and challenging nature of managing this condition. These data have been compiled through the review of case series.

Conclusion

In conclusion, obstetric management becomes particularly challenging when the pregnancy persists after PV-PPROM. It is imperative to adopt an individualised approach to obstetric management, taking into consideration factors such as the intrauterine location of the fetus with PPROM, cervical examination findings, and the presence of chorioamnionitis. Additionally, discussing potential risks and complications with the parents is crucial in making informed decisions.

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