Premature Rupture of Membranes

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Koichiro Shimoya

Abstract

In pPROM, complications such as fetal immaturity and intrauterine infection may occur, and intensive care that is distinct from that of full-term PROM is required. pPROM occurs in 25% of all PROMs, and approximately 30% of premature births involve pPROM. There are two causes of premature membrane rupture. One is the abnormality of the fetal membrane due to ascending infection from the lower reproductive organs. Another cause of premature rupture of membranes is the elevation of intrauterine pressure. The following management such as avoiding frequent internal examination, antibiotic administration, administration of adrenal steroid hormones if delivery is predicted to be between 22 and 34 weeks of gestation, confirmation of amniotic fluid volume and fetal growth by ultrasound, and fetal heart rate monitoring is considered. There are options of delivering the newborn if gestational age is more than 34 weeks and options to wait or to induce delivery after 24 h of waiting if premature rupture of membranes occurs in full-term pregnancy to manage PROM.

Keywords

pPROM · Infection · Elevation of intrauterine pressure

K. Shimoya, M.D., Ph.D. (✉)
Department of Obstetrics and Gynecology 1, Kawasaki Medical School, Kurashiki, Okayama, Japan
e-mail: shimoya@med.kawasaki-m.ac.jp

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21.1 Outline

Rupture of the fetal membranes before the onset of labor is called premature rupture of membranes (PROMs). PROM can develop at any time during the gestational period; however, when it occurs at less than 37 weeks of gestation, it is called preterm PROM (pPROM). Management of pPROM is different from that of PROM. Premature rupture that occurs at 37 weeks or later usually results in natural labor and normal delivery, and clinical obstetric and gynecological problems rarely occur. In pPROM, complications such as fetal immaturity and intrauterine infection may occur, and intensive care that is distinct from that of full-term PROM is required.

21.2 Pathology

During pregnancy, the fetus is surrounded by the amniotic membrane and buffered from shock by the amniotic fluid. In addition to this, pressure on the umbilical cord should also be avoided to maintain a steady supply of oxygen and nutrients to the fetus. The amniotic membrane separates the fetal environment from the outside environment and protects the fetus from any ascending infection from intrauterine bacteria and microorganisms.

Premature rupture of membranes occurs in 3–18% of all pregnancies and in about 10% of full-term pregnancies. pPROM occurs in 25% of all PROMs [1], and approximately 30% of premature births involve pPROM [2]. The period from PROM to the onset of labor (latency period) is inversely correlated to gestational age.

For pregnancies 28–36 weeks of gestation, 50% go into labor within 24 h, and 80–90% within 1 week. For pregnancies less than 26 weeks of gestation, approximately 50% go into labor within 1 week [3].

The structure of the fetal membrane consists of 4–6 chorion membranes and an amniotic membrane made up of a single layer of cells. These maintain the integrity of the membrane structure, but when the cells and connective tissues that constitute the membrane undergo pathological degeneration, the membrane collapses. There are two causes of premature membrane rupture. One is the abnormality of the fetal membrane due to ascending infection from the lower reproductive organs. Chorioamnionitis develops, and the proteolytic enzymes produced by migrating white blood cells weaken the collagen of the fetal membrane, leading to PROM. Premature birth is usually caused by intrauterine infection. However, the prevalence of amniotic bacteria in premature birth is 16.1%, while it is reported to be at 27.9% in pPROM. Hence, it is understood that infection plays an important role in pPROM. The inflammatory mediators induced by infection cause uterine contraction, and it is thought that the softening of the cervix that shifts the chorion and amniotic membrane is the cause of membrane rupture. It is also thought that maternal or fetal stress leads to the production of corticotrophin-releasing hormone (CRH) via the stress-dependent hypothalamus–pituitary–adrenal axis, and may also be a trigger of pPROM. Another cause of premature rupture of membranes is the

elevation of intrauterine pressure, which could be caused by several factors, such as excessive amniotic fluid, multiple pregnancies, increased abdominal pressure due to cough, and uterine malformation. Intrauterine procedures such as amniocentesis, cordocentesis, and fetoscopic laser photocoagulation for twin-to-twin transfusion syndrome may also damage the fetal membrane and cause premature rupture of membranes.

21.3 Diagnosis

Diagnosis of PROM starts with taking a detailed medical history and physical examination before and after the rupture. In most cases, there are sudden fluid leaks out of the vagina and intermittent leaks thereafter. However, if most of the amniotic fluid flows out and does not remain in the vagina, it is very difficult to detect PROM. Furthermore, contamination with urine, cervical mucus, vaginal discharge, and blood makes it difficult to identify amniotic fluid. Sterile speculum examination confirms the presence of amniotic outflow from the opening of the uterus; this is a classical diagnostic method. Next, pooling of water-soluble liquid in the vagina is checked. In case of pooling, clinical measurement of the vaginal pH is widely performed; the pH of normal amniotic fluid is within the range of 7.1–7.3, which is different from that of the vagina with a pH of 4.5 or lower. This is also confirmed by the change in the nitrazine (Amnicater) reagent to a blue color, and this test is thought to be 90–98% accurate [4]. Attention should be paid to false positives due to blood contamination. In addition to the pH test, Fern test is also useful. As an adjunct diagnostic, ultrasound can be used to measure the volume of amniotic fluid volume. Biochemical diagnostic methods include fetal fibronectin (ROM check), α-fetoprotein (Amtec), and insulin-like growth factor-binding protein 1 (IGFBP-1, Amni test Meiji Milk). It is said to be useful when one is unsure if her water is breaking (PROM or pPROM). Dye injection test can be performed by injecting indigo carmine into the uterine cavity and observing for dye leakage if a definitive diagnosis of premature rupture of membranes or low amniotic fluid levels cannot be determined with these inspection methods.

21.4 Management (Treatment)

The problem with premature rupture of membranes during full-term pregnancy is that the risk of ascending intrauterine infection increases with the passage of time. Induced labor is required in cases when there are signs of infection already; however, 90% of pregnant women usually go into labor within 24 h. The decision of whether to induce labor immediately in preterm pregnancies or to wait is largely dependent on the wishes of the patient. However, it has been reported that, even if labor was induced, the rate of cesarean section does not increase, and the rate of intrauterine infection decreases [5, 6]. Furthermore, the risk of ascending intrauterine infection in the waiting group and the induced labor group was studied,

and the maternal infection rate was significantly less in the induced labor group than in the waiting group [7]. In contrast, the frequency of chorioamnionitis within 24 h of rupture in full-term pregnancy is less than 10%, but increases up to 40% after 24 h [8]. Therefore, in principle, it is not desirable to wait for a long time, and internal examination should be minimized to prevent infection. For full-term pregnancies with positive GBS results, penicillin antibiotics are administered as a rule.

Fetal immaturity is a serious problem following pPROM, and the patient should always be admitted to a hospital. Other complications occur frequently in pPROM due to low amniotic levels, including cord problems such as umbilical cord prolapse and umbilical cord compression and attention must be given to pulmonary hypoplasia and joint contractures. In terms of maternal infections, chorionic amniotic membrane infection is found in 13–60% of cases, followed by endometriosis and sepsis. In addition to this, premature ablation of the placenta occurs in 4–12% of pPROM, and postpartum hemorrhage is also recognized in 12% of cases [9]. The aim of the management of pPROM is to prolong the pregnancy period and to wait for fetal development and maturation while paying attention to signs of intrauterine infection, maternal infection, uterine contraction, and abnormal fetal heartbeat such as fluctuating transient bradycardia. In late preterm cases, the duration in which to continue with expectant treatment in the absence of infection is a controversial issue. However, if the pregnancy is more than 34 weeks of gestation, induced labor is considered as one of the options. If symptoms of infection appear after 26 weeks of pregnancy, it is common to stop expectant treatment and choose childbirth. Furthermore, it is necessary to carry out GBS culture in preparation for the delivery.

Expectant management treatment includes administration of uterine contraction inhibitors, antibiotics, and corticosteroids; however, the administration of uterine contraction inhibitors is also controversial. Evidence-based medicine reported that administration of a uterine contraction inhibitor has no effect on prolonging long-term pregnancy, and does not improve perinatal prognosis [10–12]. Therefore, if this is strictly applied, it is only appropriate to administer a uterine contraction inhibitor after observing the effects of administering an adrenal steroid as described below. However, in reality, it is believed that the continuous administration of uterine contraction inhibitors is done in many institutions, and in some cases, the effects are actually felt. The understanding of the scientific basis of its use is poor, and attention should be given to the possible side effects of its use. On the other hand, the use of magnesium sulfate as a preventive measure against brain damage (cerebral palsy) in preterm infants has been reported [13–16], and it appears that there is also room for considering its use in cases of pPROM.

To prevent intrauterine infection, antimicrobial drugs are administered for cases of premature rupture of membranes. In a large-scale NICHD study on the administration of antibiotics for pPROM, 2 g ampicillin and 250 mg erythromycin were intravenously infused every 6 h within 48 h of rupture, and 250 mg amoxicillin and 333 mg erythromycin were administered orally every 8 h for 5 days thereafter. It is possible to extend the gestation period of the antibiotic administered group; an

improvement in the prognosis of sepsis in the neonate and a decrease in cases of chorioamnionitis were seen [17]. Furthermore, ORACLE studies have reported that a combination of amoxicillin and clavulanic acid (e.g., Augmentin) increases neonatal necrotizing enterocolitis [18]. Therefore, it is recommended to administer antibiotics for 7 days only if treatment is based on EBM. Center for Disease Control and Prevention (CDC) recommends taking measures to prevent GBS infection for 48 h [19].

It is known that maternal administration of corticosteroids in pregnant women with premature labor improves the prognosis of the fetus, but in cases of pPROM, it is suggested that there is a possibility that the administration of steroids may exacerbate infection or that PROM pathology itself promotes fetal lung maturation. Although it remains controversial, current maternal administration of corticosteroid does not increase the risk of infection, and it has been shown to lower the morbidity and mortality rate of newborns [20]. If delivery is expected 24 to less than 34 weeks, two doses of 12 mg betamethasone are administered 24 h apart for pulmonary maturation and prevention of intracranial bleeding. Although it has not been proven to be effective for pregnancies with a gestation of less than 24 weeks, administration of betamethasone is still recommended [21].

21.5 Prognosis

The factor that determines the prognosis of newborn babies is gestational age, and extending the gestation period is important. In addition to this, the presence or absence of infection also greatly influences the prognosis of the child. The death rate of newborns that developed pulmonary hypoplasia due to rupture in early pregnancy is thought to be up to 90% [22].

21.6 Summary

Attention should be paid to the following points related to premature rupture of membranes:

- Confirmation of diagnosis
- Rules for hospitalization and treatment
- Avoiding frequent internal examination
- Antibiotic administration
- Administration of adrenal steroid hormones if delivery is predicted to be between 22 and 34 weeks of gestation
- Confirmation of amniotic fluid volume and fetal growth by ultrasound
- Fetal heart rate monitoring
- Option of delivering the newborn if gestational age is more than 34 weeks
- Options to wait or to induce delivery after 24 h of waiting if premature rupture of membranes occurs in full-term pregnancy

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