The PPROM Foundation

What is PPROM?

During pregnancy, if the amniotic sac or "water" breaks prior to 37 weeks, this is considered Preterm Premature Rupture of Membranes (PPROM)[1]

· PPROM is responsible for 30-40 percent of preterm births, and impacts 150,000 women in the U.S. every year.[1]

· PPROM complicates 2% to 4% of all singleton and 7% to 20% of twin pregnancies.[1,2]

· Women have experienced PPROM in all trimesters of pregnancy.[1]

· The most common pregnancy complications related to PPROM are intra-amniotic infection (chorioamnionitis), pulmonary hypoplasia, and premature birth.[1]

Pathophysiology of the Intrauterine Environment

· The amniotic sac holds the baby in the uterus, protecting from damage and helping to regulate the baby's temperature. The sac provides a barrier from contaminants, pathogens and microorganisms that could ascend and cause intra-amniotic infection. [3,6]

· Amniotic fluid in the beginning of pregnancy consists of water delivered from the mother via the umbilical cord and through trans-membranous exchange. After 20 weeks of pregnancy, the baby takes over fluid production and fluid is produced through a cycle of urination and exhalation of fluid.

· Amniotic fluid contains water, nutrients, hormones, and antibodies. Amniotic fluid has bacteriostatic properties that helps prevent ascending infection of the intra-amniotic environment.[6]

· Amniotic fluid is inhaled, helping to develop the respiratory system. Fetal swallowing of fluid aids in the development of the digestive system. Development of the musculoskeletal system is possible as fluid provides opportunity for the baby to stretch and move. Finally, amniotic fluid helps cushion the umbilical cord, which can be vulnerable to compression as the baby grows.[6]

· The placenta is an organ of pregnancy that supports the growth and development of the baby. The placenta provides oxygen and nutrients, while removing carbon dioxide and other waste products. The placenta helps to protect the baby from infections and maternal diseases. In addition, the placenta releases hormones into both the maternal and fetal circulations to affect pregnancy, metabolism, fetal growth, labor and other functions.

· Ongoing tension from a ruptured amniotic sac can lead to separation of the placenta from the uterine wall, leading to bleeding and in many cases, placental abruption. [7]

Etiology and Risk Factors of PPROM

· PPROM is generally a result of other medical conditions or complications, but many times the cause is unknown.

· There are multiple causes for PPROM, such as: vaginal bleeding, collagen vascular disorders (Ehlers-Danlos syndrome, Systems Lupus Erythematosus), trauma, prior pProm, preterm labor, nutritional deficiencies, systemic inflammation, uterine anomalies, cervical insufficiency, infection, chorioamnionitis, Twin to Twin Transfusion syndrome, Twin Reversed Arterial Perfusion, amniocentesis, etc.

Complications

· The Top 3 Concerns of PPROM are: extreme preterm birth, chorioamnionitis / sepsis, and pulmonary hypoplasia. These are the leading causes of neonatal mortality.[1]

· Other complications are increased risk of cesarean section, umbilical cord prolapse, orthopedic defects, placental abruption, intrauterine growth restriction, perinatal demise, and post-partum hemorrhage.[1-4]

A. Extreme Premature Birth

· Viability refers to the gestational age and birth weight below which infants are too immature to survive. In the United States, viability varies from state to state. However, most providers and hospitals use an indicator of 24 weeks' gestation and weight of 500 grams to establish the "viability" of the pregnancy.

· The earliest recorded birth with a surviving infant is Lyla Stensrud of Texas, born in 2014 at 21 weeks and 4 days. Recently, there have been multiple deliveries from 22 weeks, with babies weighing less than a pound.

· There is a very high risk or morbidity and mortality for these very early premature births; survivors are at risk for ongoing health conditions related to their prematurity.

· In the U.S., approximately 8% (318,000) of all births occurred between 32-36 weeks. About 1.6% (64,000) of births are prior to 32 weeks. A baby born at 23 weeks has a 17% chance of survival, and at 27 weeks a 90% survival rate. [8] Unfortunately these statistics do not consider complications related to pProm.

· The majority of pProm babies are born prematurely. They receive treatment in the Neonatal Intensive Care Unit (NICU); many require mechanical ventilation, respiratory support, blood transfusions, enteral and parenteral nutrition, pharmacotherapy, frequent tests and imaging to monitor conditions, etc..[2-4]

· It is important that the pProm patients seek hospitals with advanced neonatal care, full time neonatology and surgery staff, nitric oxide treatment and high frequency ventilation. These facilities are generally Regional centers with a designation of Level IV (but may vary by state).[2,3]

· Common medical complications in the NICU are intraventricular hemorrhage (IVH), necrotizing enterocolitis (NEC), chronic lung disease (CLD) or bronchopulmonary dysplasia (BPD), respiratory distress syndrome (RDS), retinopathy of prematurity (ROP), patent ductus arteriosus (PDA) and persistent pulmonary hypertension of the newborn (PPHN).[10]

b. Chorioamnionitis / Sepsis

· Chorioamnionitis is a complication of pregnancy caused by bacterial infection of the fetal amnion and chorion membranes.[5] Neonatal Sepsis is a serious blood infection resulting from chorioamnionitis.

· The clinical signs for chorioamnionitis are: Maternal fever >100.4°F, maternal tachycardia (>120 beats/min), fetal tachycardia (>160-180 beats/min), foul-smelling amniotic fluid or vaginal discharge, uterine tenderness, Maternal leukocytosis (white blood cell count >15,000-18,000 cells/μL).[5]

· Unfortunately, chorioamnionitis is very difficult to diagnose. Typically, the provider seeks two or more of the symptoms above when making a diagnosis, but may seek additional laboratory tests or clinical signs to confirm.

· Full-fledged infection due to chorioamnionitis can present in a matter of hours. Along with broad spectrum antibiotics, expedient delivery of the baby is necessary.[5]

· Multiple microorganisms are known to cause chorioamnionitis. Blood and amniotic fluid cultures can be obtained to find the specific organism and treat it effectively. However, these cultures take over 3 days to process and in most cases, the mother will deliver before results are received.[3,5]

· While maternal mortality is extremely rare today, infants born prematurely to mothers with chorioamnionitis are at an increased risk of death, cerebral palsy, pulmonary insufficiency, and other adverse effects.[5]

c. Pulmonary Hypoplasia

· Pulmonary hypoplasia is a medical condition related to incomplete development of lung tissue. The neonatal lungs have fewer lung cells, airways, and alveoli due to prolonged Oligohydramnios (low amniotic fluid).[13]

· For lungs to properly develop in pregnancy, they require a specific volume and pressure of amniotic fluid in the trachea and lungs. Amniotic fluid presence and volume is crucial in the canalicular stage of fetal lung development between 15-28 weeks' gestation.[13]

· There is no well-defined test to predict pulmonary hypoplasia; ultrasounds and other imaging studies are insufficient in visualizing lung tissue and development in the antenatal period. [12]

· Post-delivery, the neonatology team will attempt to stabilize, resuscitate and obtain radiographic images of the chest. Respiratory support such as high frequency ventilation, surfactant, and nitric oxide are all standard neonatal treatments to help improve function and oxygenation in the lungs.[2-4, 10, 11, 13]

· In the NICU, secondary complications in infants born with pulmonary hypoplasia are persistent pulmonary hypertension of the newborn (PPRN), pneumothorax, pulmonary interstitial emphysema (PIE), prolonged mechanical ventilation, bronchopulmonary dysplasia (BPD) and chronic lung disease (CLD). [11]

· In pProm pregnancies that reach 32 weeks, a fetal lung maturity test can be done via amniocentesis using a sample of amniotic fluid. This test is most specific for ruptured membranes at 32 weeks or later. [3]

Diagnosis

· PPROM is a clinical diagnosis. There are multiple tests that can be administered to confirm ruptured membranes. Diagnosis is individualized based upon the symptoms the patient is experiencing, as many of the tests can result in false positives or false negatives if administered incorrectly.[3]

· The first symptom most women experience is a gush of fluids from the vagina. In some cases, women believe that they have incontinence or increased leukorrhea. [3]

· The medical provider will review the history of signs and symptoms, then may utilize a sterile speculum to visualize the cervix. Depending on the test preferred, the provider will attempt to gather a sample of fluid or use a sterile swab to sample fluids near the cervix. [1-3]

· Ultrasound is the least invasive measure to evaluate ruptured membranes; however low amniotic fluid (Oligohydramnios) may not be immediately evident in the event of a slow, high leak.

· Following diagnosis, it is recommended that women consult with a perinatologist or Maternal-Fetal Medicine Specialist. An MFM is an obstetrician/gynecologist who has completed 4 years of obstetrics training followed by 2-3 years of additional education and clinical experience. They have specialized skills and training to help both the mom and baby during a high-risk pregnancy. [1,3]

Treatment

- There are three treatment options in pregnancies affected by PPROM: elective termination of pregnancy, expedient induction of pregnancy, and Expectant Management. Much depends on the gestational age at rupture and presenting complications (infection, fetal or maternal distress). [1-3]
- Treatment must be individualized, especially with consideration of gestational age at rupture and with an assessment of the predicted maternal, fetal, and neonatal risks for complications.[3]
- Traditionally, termination of pregnancy pre-viability was the preferable option because of the presumed risk of maternal sepsis and very poor fetal outcome.[4]
- In the past two decades, there has been a dramatic improvement in neonatal outcomes after preterm birth because of the use of antenatal corticosteroids[2]
- Expectant Management in PPROM includes therapy directed toward extending the pregnancy to improve neonatal outcome. [2]
- Latency is how providers describe the time span between the amniotic sac breaking and delivery. The more preterm at the time of rupture, the longer the latency period is between rupture and delivery.[2]
- The patient choosing Expectant Management must monitor symptoms closely for infection, watch for contractions or signs of labor, avoid unnecessary internal exams, attend regular appointments with the maternal-fetal medicine specialist, comply with activity level as directed by the physician, and notify the provider in the event of any changes to condition.
- From 23-24 weeks, patients will be admitted to an antepartum hospital unit, where the physician will regularly monitor for infection, labor, placental abruption, growth restriction, and other complications of pregnancy. Regular ultrasounds and tests may be completed to ensure the mother and baby are not in distress. [1-3]
- In the event that pProm occurs beyond 32 weeks, the patient will be assessed and scheduled for induction between 34-36 weeks unless immediate delivery is necessary due to active labor, maternal/fetal distress, or infection. [1,3]
- Antepartum medical treatments in Expectant Management include antibiotics, corticosteroids, and magnesium sulfate for neuroprotection. [1-3]
- Tocolytics to slow contractions or uterine activity are contraindicated in pProm. Some physicians consider labor to be a probable sign of intrauterine infection and therefore a contraindication to tocolytic therapy.[3]
- Controversial treatments include serial amnio-infusion and amniopatch; neither are widely available to PPROM patients and further study is needed.[2,4]

Statistics and Outcomes

- Many dated studies report that for women diagnosed with PPROM, 50% will go into labor within 24 to 48 hours and up to 90% will deliver within 7 days. Unfortunately, most these studies are outdated, have small sample sizes, lack pre-viability results, and make no differentiation between natural labor and elected termination of pregnancy. [2-4]
- If a pregnancy continues successfully without maternal or fetal distress or labor, induction will be scheduled between 34-36 weeks. Studies demonstrate increased risks of neonatal and maternal morbidity due to sepsis. [1, 3]
- A recent study reports a 90% survival rate for infants exposed to prolonged PPROM occurring between 18-24 weeks who were delivered after 24 weeks. Survivors required aggressive treatment in the NICU.[2] These data suggest that neonatal survival is possible after pre-viability PPROM with expectant management, antenatal corticosteroids, and a skilled neonatal team prepared to provide high-frequency ventilation, and inhaled nitric oxide therapy.[2]
- Survival rates improve the later PPROM occurs, but average latency (time between rupture and delivery) decreases. Preterm birth is the most serious complication of pProm.[2]
- Gestational age at birth rather than gestational age at rupture or latency is the key predictor of survival after PPROM.[2]
- Resealing is considered a rare occurrence, but is more likely to take place following amniocentesis.[3]
- Prolonged exposure to an intrauterine environment of PPROM does not increase the risk of neonatal sepsis. Prolonged PPROM over four weeks was associated with decreased risk of neonatal sepsis. [5]
- Pregnancies complicated by PPROM are associated with PTSD in a substantial number of women and their partners. Women with proven vulnerability for psychological problems are at risk of developing PTSD postpartum, as are women whose children died in the perinatal or neonatal period.[14]

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