MATERNAL911®

Preterm Premature Rupture of Membranes (PPROM)

Click the next button to continue...

Copyright ©2022 Shelly Betancourt and Michelle Becher

All rights reserved. No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the publisher, except in the case of brief quotations embodied in critical reviews and certain other noncommercial uses permitted by copyright law. For permission requests, write to the publisher at the address below.

Maternal 911 Education Systems, LLC
475 West Center St.
Ithaca, MI 48847
www.maternal911.com

Maternal 911 and Maternal 911 in Action contains information designed as an educational resource to aid practitioners in providing obstetric care and the use of this information is voluntary. This information should not be considered as inclusive of all proper treatments or methods of care or as a statement of the standard of care. It is not intended to substitute for the independent professional judgement. Maternal 911 reviews the publication regularly, but may not reflect the most recent evidence.

Maternal 911 makes every effort to present accurate and reliable information. The Maternal 911 and Maternal 911 in Action are publications provided 'as is' without any warranty of accuracy, reliability or otherwise, either express or implied. Maternal 911 does not guarantee, warrant, or endorse the products or services of any firm, organization, or person. Neither co-founder nor any officers, directors, members, employees, participants or agents will be liable for any loss, damage or claim with respect to liabilities, including direct, special, indirect, or consequential damages, incurred in connection with this publication or reliance on the information presented.

Data from completing the modules may be used in research and publications with privacy maintained.

Course Description:

Leaking fluid? We have problems! Preterm Premature Rupture of Membranes (PPROM) continues to be a leading cause of neonatal morbidity and mortality. This module will help to develop a knowledge base to further the care of a woman with PPROM.

Approximate Time to Complete: 45 minutes

Click here to download a print version of this course.

In this course the participant will:

- Recognize the risk factors for PPROM.
- The signs and symptoms of PPROM will be recognizable after this module.
- Better understand the physical exam of a woman suspected to have PPROM.
- Have a better understanding of the serious infections that can occur with PPROM patients.
- Understand possible complications for a woman and her developing fetus when she is faced with PPROM.
- Formulate the plan of testing a mother presenting with signs and symptoms of PPROM to help determine if the membranes have ruptured prematurely.
- Be able to explain the controversy with treatment tracks and understand the nuances to the treatment options.
- Gain knowledge on the medication regimens for PPROM based on the gestational age of the fetus.

MATERNAL911®

- Background Information
  - Definition
  - Definition con't
  - Risk Factors
- Diagnosis
  - Diagnosing PPROM - Clinical Course
  - Diagnosis of ROM
  - Risks of PPROM
  - Diagnosing PPROM
  - Differential Diagnosis
- Management
  - Management
  - Initial Approach
  - Management
  - Management
  - Potential Fetal Consequences
  - Special Circumstances
- Delivery
  - Cervical Ripening
- Summary
  - Summary
  - Course Completed Page

Premature rupture of membranes (PROM)

Rupture of membranes before the onset of labor. Also called Prelabor Rupture of Membranes.

Preterm PROM (PPROM)

PROM before 37 weeks gestation

Term PROM

- *Complicates 8% of pregnancies.*
- *95% of women will deliver within 28 hours after membrane rupture [1].*

Preterm PROM

- *Accounts for ~25% of preterm deliveries.*
- *50% of women will deliver within one week of PPROM*
- *The latency period between PPROM and delivery increases with decreasing gestational age; therefore, a women who experiences PPROM at 22-24 weeks may remain pregnant longer than a woman who experiences PPROM at 28-30 weeks [1].*

PPROM Risk Factors

- Most preterm births secondary to PPROM occur in women with no risk factors.
- The biggest risk factor for PPROM is a prior spontaneous preterm delivery [2].

Modifiable Risk Factors	Non-Modifiable Risk Factors
Smoking	Prior preterm delivery
Poor nutrition	Subclinical intraamniotic infection
Illicit drug use	Urinary tract infection
	Sexually transmitted infection
	Severe polyhydraminos
	Short cervical length
	Bleeding in pregnancy

PPROM Risk Factors

Previous PPROM

- The risk of recurrence is estimated at 13-32% [3,4].
- This risk may be decreased with use of supplemental progesterone and cervical length surveillance in a subsequent pregnancy.

PPROM Risk Factors

Genital Tract Infection

- The single most common identifiable risk factor for PPROM.
- Three lines of evidence support this association:
  - Women with PPROM are significantly more likely than women with intact membranes to have pathogenic microorganisms in the amniotic fluid.
  - Women with PPROM have a significantly higher rate of histologic chorioamnionitis than those who deliver preterm without PPROM.
  - Lower genital tract infections, particularly bacterial vaginosis, has been associated with higher rates of PPROM [5].
  - The pathophysiology that may contribute to this association includes the following:
    - Lower genital tract organisms can produce phospholipases, which may stimulate prostaglandin production and contribute to uterine contractions.
    - The woman's immune response to bacterial invasion can lead to increased production of inflammatory mediators that may cause weakening of the fetal membrane [5].
    - The woman's immune and inflammatory response is genetically regulated, which may play a role in an individual's susceptibility and response to bacteria and infections.

PPROM Risk Factors

Antepartum bleeding

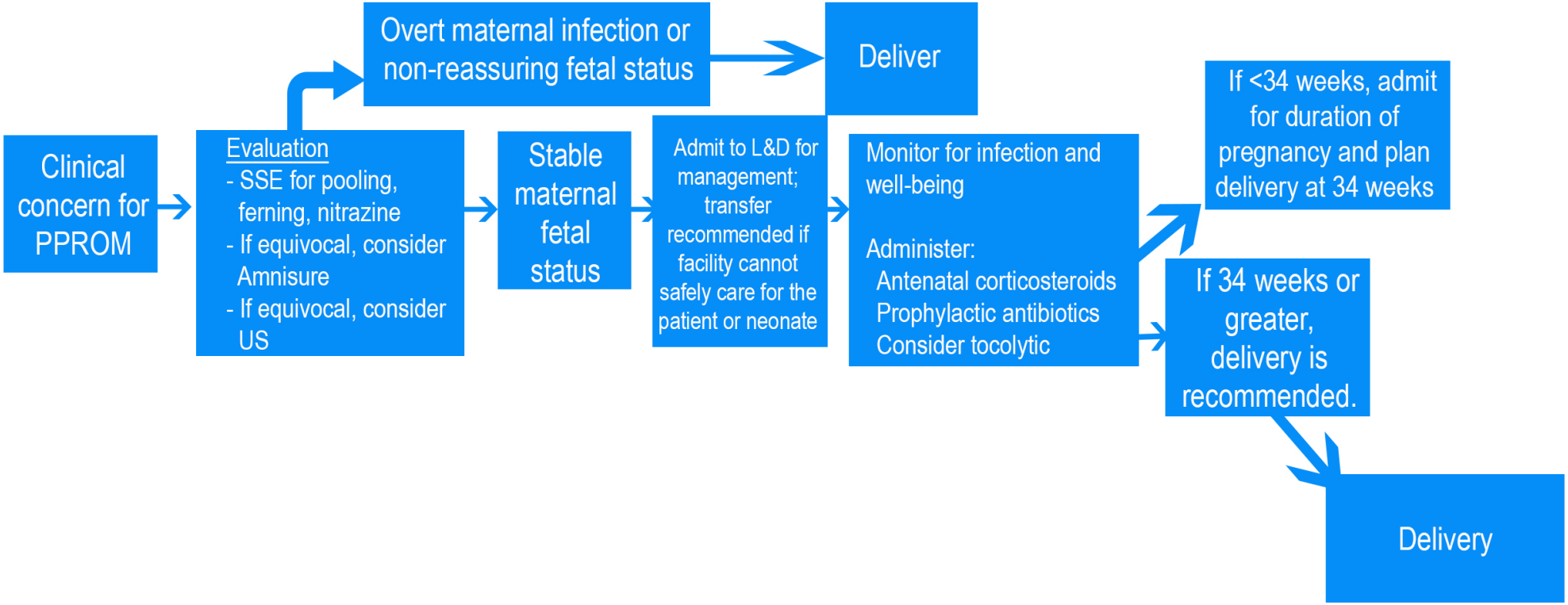
- When antepartum bleeding occurs in the first trimester, there is a statistically significant increase in the risk of PPROM [6].
- Bleeding in more than one trimester increases the risk of PPROM by 3-to-7 fold [2,7,8].

Cigarette smoking

- Smoking is associated with a 2-4x increased risk of PPROM [8].

Click the next button to continue with the lesson

Algorithm: Managing PPROM
23-34 Weeks Gestation



Increased risk of placental abruption and prolapsed umbilical cord occurs with PPROM.

- Placental abruption occurs in 2 to 5% of pregnancies complicated by PPROM [19-22].
- Placental abruption risk increases even further with an increase of 7-9 fold in PPROM pregnancies when intrauterine infection or oligohydramnios is present [20, 21].
- Placenta abruption may be the event that either causes PPROM or the consequence of PPROM.

It is common to have fetal malpresentation and reduced AFV at a preterm gestational age.

- The cord prolapse risk is especially high, up to 11% in one study [23], when both non-vertex fetal presentation occurs with PPROM.
- This malpresentation may also increase the risk of abruption, infection, and fetal death in utero [24].

When PPROM occurs early, is severe and with prolonged oligohydramnios, it can be associated with pulmonary hypoplasia, facial deformation, and orthopedic abnormalities.

- These complications are much more likely when membrane rupture occurs under 23 weeks of gestation.

Nitrazine

Ferning

Ultrasonography

AmniSure

fFN

Amniodye Test

- Diagnosis of ROM is made by conventional clinical assessment evaluating for pooling, ferning and nitrazine via sterile speculum exam.
- If the diagnosis remains uncertain after this initial evaluation, further testing can be performed

Click each term to the left to learn more about diagnosing PPROM.

Nitrazine

Ferning

Ultrasonography

AmniSure

fFN

Amniodye Test

- The typical pH range of amniotic fluid is 7.0 to 7.3 which is much higher than the typical vaginal pH of 3.8 to 4.2 [25].
- In up to 5% of testing, a false negative or false positive result occurs.
- A false negative result can occur if the leakage is intermittent, the amniotic fluid is diluted by other vaginal fluid or in the setting of prolonged membrane rupture and minimal residual amniotic fluid.
- A false positive result can occur in the presence of alkaline vaginal fluid including blood, semen, lubricants, trichomonas or bacterial vaginosis.
- Urinary tract infections with Proteus species can also increase the pH causing a false positive result

Nitrazine

Ferning

Ultrasonography

AmniSure

fFN

Amniodye Test

- To assess for ferning, obtain a vaginal swab from the posterior fornix and apply the swab to a glass microscope slide and allow drying to occur.
- Dried amniotic fluid produces a delicate ferning pattern, otherwise called arborization.
- A false positive result can be caused by cervical mucus.
- A false negative result can be caused by insufficient amniotic fluid or blood.

Nitrazine

Ferning

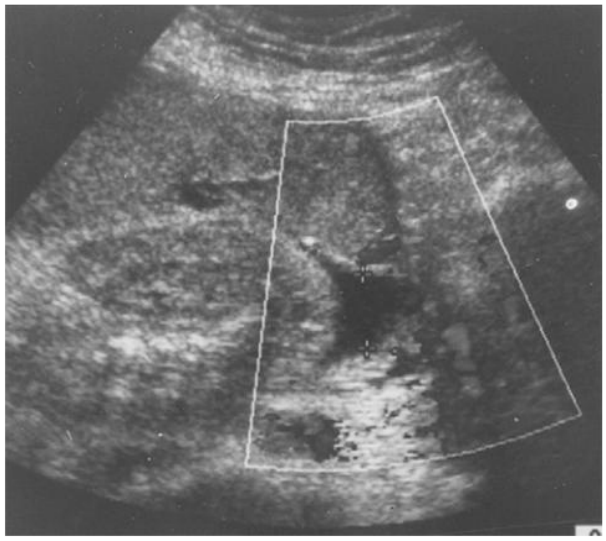
Ultrasonography

AmniSure

fFN

Amniodye Test

- If ROM has occurred, ultrasound can be a helpful diagnostic tool.
- Oligohydramnios, which is diagnosed with a maximal vertical pocket <2 cm or amniotic fluid volume <5 cm, is suggestive of ROM.



Nitrazine

Ferning

Ultrasonography

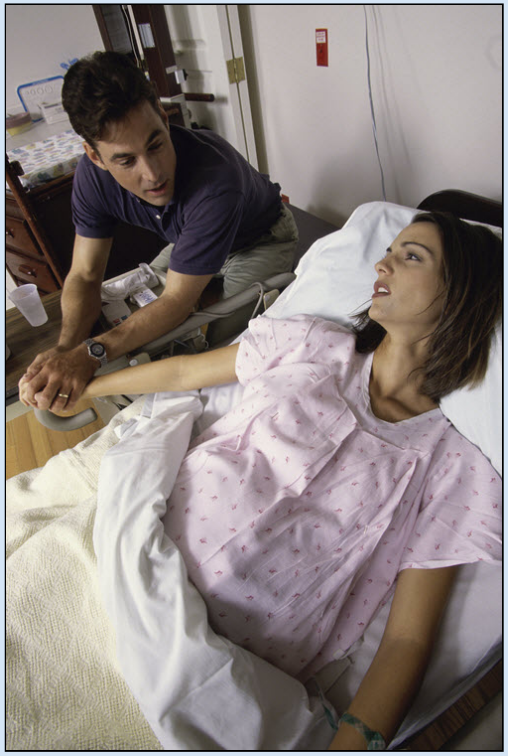
AmniSure

fFN

Amniodye Test

- AmniSure is a rapid test using immunochromatography to detect trace amounts of placental alpha microglobulin-1 protein in vaginal fluid.
  - Similar commercially available tests include ROM Plus and Actim PROM.
- The kit has a sterile swab, which is inserted into the vagina for one minute, then placed into a vial containing a solvent for one minute and then an AmniSure test strip is dipped into the vial.
- The result is revealed by the presence of lines after the next 5-10 minutes:
  - No visible line is an invalid result
  - One visible line is a negative result
  - Two visible lines is a positive result
- The sensitivity ranges from 94.4-98.9% with a specificity range of 87.5-100% in large studies [26-30].
- Recent studies have demonstrated false positive rates of 19-30% and there are reports of fetal death and adverse pregnancy complications related to the use of these tests [31].
- The US Food and Drug Administration and American College of Obstetricians and Gynecologists caution use of these tests without standard clinical assessment [31].

- Nitrazine
- Ferning
- Ultrasonography
- AmniSure
- fFN
- Amniodye Test



A negative fetal fibronectin result strongly supports the absence of membrane rupture.

A positive result only indicates disruption of the interface between chorion and decidua, which can occur with intact membranes [32].

- Nitrazine
- Ferning
- Ultrasonography
- AmniSure
- fFN
- Amniodye Test

- If there continues to be uncertainty in the diagnosis of PPROM, an Amniodye test can be performed for definitive diagnosis.
- Utilizing ultrasound guidance, 1 mL of indigo carmine diluted in 9 mL of sterile saline is injected transabdominally into the amniotic fluid.
- A tampon is placed in the vagina and should remain in place for 2-3 hours.
- After the tampon is removed, it is examined for evidence of blue staining. If the tampon is blue, this is diagnostic of PPROM. If the tampon is not blue, PPROM has not occurred.
- The Amniodye test can cause blue staining of maternal urine; therefore, care should be taken to avoid urinary contamination.
- If indigo carmine cannot be obtained, sodium fluorescein can be used as a substitute. Methylene blue is contraindicated due to risk of fetal death and fetal intestinal atresia.

- Alternative Causes of Vaginal Discharge:
  - Urinary incontinence
  - Vaginal discharge
  - Perspiration
  - Vaginal infection

- Several controversies exist regarding the management of PPROM.
- Points of contention include:
  - Use of tocolytics
  - Rescue course of antenatal corticosteroids
  - Methods of testing for maternal/fetal infection
  - Timing of delivery
  - Management of periviable PPROM

PPROM management in women is based upon consideration of several factors, which are assessed at presentation:

- Gestational age
- Presence or absence of maternal and/or fetal infection
- Presence or absence of labor
- Fetal presentation
- Fetal well-being
- Cervical status by visualization using a sterile speculum
- Availability of neonatal intensive care unit (NICU)

Table 2: Complications with PPROM

Pregnancy Complications	Potential Consequences for Offspring	Potential Maternal Consequences
Intrauterine infection	• Neonatal sepsis • Long-term neurodevelopmental abnormalities, particularly cerebral palsy	Postpartum endometritis
Umbilical cord Compression	Fetal asphyxia	Cesarean delivery
Oligohydramnios	• Limb restriction deformities • Pulmonary hypoplasia	
Fetal malpresentation		Cesarean delivery
Umbilical cord prolapse	Fetal asphyxia	Cesarean delivery
Placental abruption	Fetal asphyxia	• Cesarean delivery • Coagulopathy • Hemorrhage
Preterm birth	Risks correlates with gestational age at delivery	

1

2

- The majority of pregnancies with PPROM deliver within one week of membrane rupture.
- A randomized trial of PPROM at 24-32 weeks showed the median time to delivery of 239 group B streptococcal (GBS) negative women managed expectantly with prophylactic antibiotics was 6.1 days along with the following observations:
  - 27% delivered within 48 hours
  - 56% delivered within 7 days
  - 76% delivered within 14 days
  - 86% delivered within 21 days [13]

1

2

- The duration of latency inversely correlates with gestational age at membrane rupture [14].
- Once PPROM has been diagnosed, spontaneous resealing of the membranes has been reported to occur in 3-13% of pregnancies [15].
- If PPROM occurs after amniocentesis, the rate of spontaneous resealing is much higher, with reported rates of 86-94% [15].

Diagnosis of ROM

The classic presentation of PROM is a sudden gush of clear fluid from the vagina. Most cases can be diagnosed based on history and physical exam.

Physical exam:

- Physical exam should minimize the risk of introducing infection.
- Digital cervical exams should be avoided unless there is concern for active labor or imminent delivery.
- Digital cervical exams are associated with increased risk of intraamniotic infection without benefit of obtaining information that cannot be gathered by speculum exam [9-11].
- Sterile speculum exam (SSE) is the recommended initial evaluation for a woman with concern for ROM.
- SSE allows assessment of cervical dilation and effacement, pooling of amniotic fluid, evaluation for umbilical cord prolapse and fetal presentation, evaluation for cervicitis and collection of vaginal cultures, if needed.

On ultrasonography:

- 50-70% of women with PPROM to have low amniotic fluid volume (AFV) on initial sonography [12].
- Anhydramnios on ultrasound correlates highly with ROM.

Management

- Laboratory assessment
  - Complete blood count with differential
  - Culture for Neisseria gonorrhoeae, Chlamydia trachomatis, Trichomonas vaginalis, and bacterial vaginosis
- Urine culture
- Rectovaginal culture for GBS
- Ultrasound to determine
  - Fetal growth
  - Fetal position
  - Residual amniotic fluid volume
  - Fetal anatomy
- Placental location
- Fetal monitoring and tocodynamometry

Antenatal Corticosteroids
Antibiotic Therapy
Magnesium Sulfate
Chemoprophylaxis for GBS
Tocolysis
Supplemental Progesterone
Hospitalization
Maternal Monitoring
Fetal Monitoring

- Antenatal corticosteroids are recommended if PPROM is diagnosed at 23-34 weeks.
  - Consideration can be given for administration at 22 weeks.
  - Steroids can also be administered at 34-37 weeks, if not received previously in pregnancy; however, delivery should not be delayed for the purposes of steroid administration.
- Antenatal corticosteroids are associated with 30-60% decreased risk of:
  - Neonatal death
  - Respiratory distress
  - Intraventricular hemorrhage
  - Necrotizing enterocolitis
  - Risk reduction is more profound with extreme preterm deliveries
  - There is no evidence of increased risks to patient or fetus with administration of antenatal corticosteroids [33, 34].
- The use of a rescue course of steroids is controversial as available data on potential benefits and harms are not definitive in this setting [35-37].
- It is reasonable to provide a rescue course of steroids if, at least two weeks have passed since the initial course of antenatal corticosteroids, and the initial course was given under 28 weeks gestation.
- Antenatal corticosteroids typically includes betamethasone 12 mg q 24 hours for 2 doses

Click each term to learn more.

Antenatal Corticosteroids
Latency Antibiotics
Magnesium Sulfate
Chemoprophylaxis for GBS
Tocolysis
Supplemental Progesterone
Hospitalization
Maternal Monitoring
Fetal Monitoring

- Antibiotics have been shown to prolong latency and to reduce the risk of early onset neonatal GBS infection.
- Latency antibiotics are indicated for all women who present with PPROM prior to 34 weeks.
  - If PPROM is diagnosed prior to 23 weeks, latency antibiotics are not typically administered until 23 weeks gestation.
- Latency antibiotics should include:
  - 48 hour course of:
    - Erythromycin 250 mg q 6 hours
      AND
    - Ampicillin 2 g q 6 hours
  - Followed by 5 days of:
    - Erythromycin 333 mg q 8 hours
      AND
    - Amoxicillin 250 mg q 8 hours [14].
- If erythromycin is not available or tolerated, azithromycin 1 g x 1 dose can be used as an alternative [38].
- Prolonged antibiotic therapy after the initial 7 day course is not recommended.
- Goals of antibiotic therapy include reduction in frequency of maternal and fetal infection, thereby delaying the onset of preterm labor, and prolonging latency and the need for preterm birth.
- Compared with placebo or no treatment, antibiotic use was associated with significant reductions in:
  - Chorioamnionitis

Click each term to learn more.

Antenatal Corticosteroids
Latency Antibiotics
Magnesium Sulfate
Chemoprophylaxis for GBS
Tocolysis
Supplemental Progesterone
Hospitalization
Maternal Monitoring
Fetal Monitoring

- If erythromycin is not available or tolerated, azithromycin 1 g x 1 dose can be used as an alternative [38].
- Prolonged antibiotic therapy after the initial 7 day course is not recommended.
- Goals of antibiotic therapy include reduction in frequency of maternal and fetal infection, thereby delaying the onset of preterm labor, and prolonging latency and the need for preterm birth.
- Compared with placebo or no treatment, antibiotic use was associated with significant reductions in:
  - Chorioamnionitis
  - Delivery within 48 hours
  - Neonatal infection
  - Use of surfactant
  - Neonatal oxygen therapy
- Targets of antibiotic therapy include:
  - Ampicillin and Amoxicillin
    - group B streptococcus
    - many aerobic gram-negative bacilli
    - some anaerobes
  - Azithromycin
    - Ureaplasma for chorioamnionitis with PPROM
    - Chlamydia trachomatis (cause of neonatal conjunctivitis and pneumonitis)
- If the woman is at high risk for anaphylaxis and GBS is resistant to clindamycin,

Click each term to learn more.

Antenatal Corticosteroids
Latency Antibiotics
Magnesium Sulfate
Chemoprophylaxis for GBS
Tocolysis
Supplemental Progesterone
Hospitalization
Maternal Monitoring
Fetal Monitoring

- many aerobic gram-negative bacilli
- some anaerobes

- Azithromycin
  - Ureaplasma for chorioamnionitis with PPROM
  - Chlamydia trachomatis (cause of neonatal conjunctivitis and pneumonitis)

- If the woman is at high risk for anaphylaxis and GBS is resistant to clindamycin, per lab results, the following treatment regimen is recommended
  - Azithromycin 1 gram orally upon admission, PLUS
  - Vancomycin 20mg/kg every 8 hours (maximum single dose is 2 grams) for 48 hours
- If the woman has a history of high risk for penicillin allergy, it is suggested she be given:
  - Azithromycin 1 gram orally upon admission, plus
  - Clindamycin 900mg IV every 8 hours for 48 hours, plus
  - Gentamicin 5mg/kg actual body weight IV every 24 hours for two doses, followed by
  - Clindamycin 300mg orally every eight hours for five days. This regimen is appropriate for patients with a positive GBS culture and laboratory-documented GBS susceptibility to clindamycin
- If the women has a low-risk penicillin allergy, antibiotic therapy suggested is a one time oral dose of azithromycin 1g and cefazolin 1g IV Q 8 hours for 48 hours, followed by cephalexin 500mg orally four times daily for five days. These drugs provide coverage for both GBS and Escherichia coli, which are two major causes of neonatal infection.

Click each term to learn more.

Antenatal Corticosteroids

Latency Antibiotics

Magnesium Sulfate

Chemoprophylaxis for GBS

Tocolysis

Supplemental Progesterone

Hospitalization

Maternal Monitoring

Fetal Monitoring

- Tocolysis has a principal indication in the setting of PPROM, in order to delay delivery 48 hours, allowing for administration of corticosteroids.
- If PPROM is diagnosed at <32 weeks gestation, magnesium sulfate is recommended for fetal neuroprotection.
- There is no clear consensus for the optimal dosing or duration of treatment.
- If there is evidence of imminent delivery, magnesium should be infused for fetal neuroprotection.

Click each term to learn more.

Antenatal Corticosteroids
Latency Antibiotics
Magnesium Sulfate
Chemoprophylaxis for GBS
Tocolysis
Supplemental Progesterone
Hospitalization
Maternal Monitoring
Fetal Monitoring

- GBS prophylaxis is indicated when GBS test results are positive or unknown.
- If GBS status remains unknown and the patient develops preterm labor within the first 48 hours of diagnosis, it is recommended to continue ampicillin from latency antibiotics for GBS prophylaxis.
- If GBS status remains unknown (or is positive) and the patient develops preterm labor after the first 48 hours, it is recommended to start standard IV antibiotics for GBS prophylaxis - penicillin G 5 million units followed by 3 million units q 4 hours.
- If the woman is at high risk for anaphylaxis and GBS is resistant to clindamycin, per lab results, the following treatment regimen is recommended:
  - Azithromycin 1 gram orally upon admission, PLUS
  - Vancomycin 20mg/kg every 8 hours (maximum single dose is 2 grams) for 48 hours
- Algorithm's are available for GBS prevention from the Centers for Disease Control and Prevention

Click each term to learn more.

Antenatal Corticosteroids
Latency Antibiotics
Magnesium Sulfate
Chemoprophylaxis for GBS
Tocolysis
Supplemental Progesterone
Hospitalization
Maternal Monitoring
Fetal Monitoring

- Tocolysis has a principal indication in the setting of PPROM, in order to delay delivery 48 hours, allowing for administration of corticosteroids.
- If PPROM is diagnosed at <34 weeks, tocolysis can be considered for the first 48 hours to allow administration of a course of antenatal corticosteroids.
- Tocolysis is not recommended in the setting of chorioamnionitis or placental abruption.
- Tocolysis is not recommended beyond the first 48 hours.
- If the patient is <32 weeks, tocolysis can include indocin or magnesium sulfate.
- If the patient is 32-34 weeks, tocolysis can include nifedipine.

Click each term to learn more.

Antenatal Corticosteroids
Latency Antibiotics
Magnesium Sulfate
Chemoprophylaxis for GBS
Tocolysis
Supplemental Progesterone
Hospitalization
Maternal Monitoring
Fetal Monitoring

- There is no evidence to suggest supplemental progesterone extends the latent period in women with PPROM.
- If the patient has been on supplemental progesterone secondary to prior PTD, continuation of IM progesterone has not been demonstrated to prolong latency; therefore should not be continued [31].
- There is no data on the efficacy or safety of continuation of vaginal progesterone in the setting of PPROM. Given the theoretical risk of introducing infection by daily administration, continuation of vaginal progesterone is not recommended [31].

Click each term to learn more.

Antenatal Corticosteroids
Latency Antibiotics
Magnesium Sulfate
Chemoprophylaxis for GBS
Tocolysis
Supplemental Progesterone
Hospitalization
Maternal Monitoring
Fetal Monitoring

- Women with PPROM diagnosed at 23 weeks or beyond are recommended to remain hospitalized until delivery due to the unpredictable nature of pregnancy complications.
- All women should be given sequential compression devices to prevent VTE.
- If additional risk factors for VTE are present, consideration should be given for administration of Lovenox 40 mg daily or Heparin 7,500-10,000 units BID.
- Women with additional risk factors for deep venous thrombosis (DVT) should receive prophylactic doses of enoxaparin (Lovenox).

Click each term to learn more.

Antenatal Corticosteroids
Latency Antibiotics
Magnesium Sulfate
Chemoprophylaxis for GBS
Tocolysis
Supplemental Progesterone
Hospitalization
Maternal Monitoring
Fetal Monitoring

- All women with PPROM are recommended to remain inpatient for close monitoring of maternal and fetal status.
- There is no clear consensus for the best approach to monitoring [39].
- Maternal vital signs should be monitored regularly.
- Assessment for uterine tenderness should be performed daily.
- Consider obtaining CBC with differential if there is clinical concern for infection.
- There is no clear evidence that amniocentesis is helpful in the diagnosis of intraamniotic infection; however, it may be considered if there is clinical concern and uncertainty in the diagnosis.

Click each term to learn more.

Antenatal Corticosteroids
Latency Antibiotics
Magnesium Sulfate
Chemoprophylaxis for GBS
Tocolysis
Supplemental Progesterone
Hospitalization
Maternal Monitoring
Fetal Monitoring

- All women with PPROM are recommended to remain inpatient for close monitoring of maternal and fetal status.
- There is no clear consensus for the best approach to fetal monitoring [40].
- Fetal monitoring should be performed at least daily.
  - Daily or BID NSTs can be considered
  - If NST is not reactive, BPP can be considered; however, in the setting of PPROM, the biophysical profile may not provide reassurance due to the common finding of oligohydramnios/anhydramnios [13].
  - Umbilical artery Dopplers have no predictive value in the setting of PPROM and should not be performed without an alternative indication [41-43].

Click each term to learn more.

The fetus/neonate is at greater risk of PPROM-related morbidity and mortality than the mother.

- Neonatal sepsis can occur from intrauterine infection with long term neurodevelopmental abnormalities, particularly cerebral palsy.
- Umbilical cord compression can lead to fetal asphyxia.
- Limb restriction deformities and pulmonary hypoplasia may result from oligohydramnios; primarily with severe oligohydramnios in early to mid second trimesters.
  - When membranes rupture occurs after 23 weeks, these complications are rare.
- Umbilical cord prolapse may lead to fetal asphyxia.
- Abruptio placentae may also lead to fetal asphyxia.
- Preterm birth may lead to
  - Respiratory abnormalities
  - Intraventricular hemorrhage (IVH)
  - Necrotizing enterocolitis (NEC)
  - Retinopathy of prematurity
  - Patent ductus arteriosus (PDA)

Click the arrows below to view the slides.

Women with HSV or HIV

- Controversy exists with the expectant management of women with PPROM and genital herpes simplex virus (HSV) or human immunodeficiency virus (HIV) and opinions regarding the best course of action diverge widely.
- Given that there is no clear consensus, treatment of women with these unique scenarios should be individualized.

Click the arrows below to view the slides.

Women with Cerclage

- There is no specific guideline for management of a woman with PPROM with cervical cerclage in place.
- Either retention or removal of cerclage is reasonable and the decision should be individualized based on the entire clinical scenario.
- Whether a cerclage is removed or not, the patient should be treated with the standard approach for PPROM.

Click the arrows below to view the slides.

Tissue Sealants

- Neither the safety nor the efficacy has been established for tissue sealants. However, there are some case reports of a variety of tissue sealants (i.e. fibrin glue, gelatin sponge) showing some success in cases of PPROM.

Click the arrows below to view the slides.

Diagnosis and Treatment of Overt Infection

- When there is maternal fever with associated leukocytosis, maternal and fetal tachycardia, uterine tenderness, and malodorous discharge, overt chorioamnionitis can be clinically diagnosed.
- In some countries, evaluation of infection can be performed using a rapid test for interleukin-6 (IL-6). This is the most sensitive marker for microbial invasion of the amniotic sac.
- Women who develop overt infection require delivery and therapy with therapeutic, rather than prophylactic antibiotics.
- If the clinical presentation is unclear and there is ongoing concern for intraamniotic infection, amniocentesis can be performed to further evaluate for evidence of intraamniotic infection.

Gestation at 23 - 32 Weeks

Gestation at 32w0d - 33w6d

Gestation at 34 Weeks+

23 - 32 Weeks

- Administer corticosteroids
- Administer latency antibiotics and give GBS prophylaxis at delivery, if indicated.
- Consider administration of a tocolytic for the first 48 hours if there is evidence of uterine contractions.
- It is appropriate to manage pregnancies at this gestational age expectantly in the absence of complications:
  - Infection
  - Abruption
  - Cord prolapse
  - Unstable fetal presentation
  - Nonreassuring fetal assessment
- If delivery is going to occur prior to 32 weeks, magnesium sulfate is recommended for fetal neuroprotection.
- If patient and fetus remain stable, delivery is recommended at 34 weeks.

Gestation at 23 - 32 Weeks

Gestation at 32w0d - 33w6d

Gestation at 34 Weeks+

32w0d - 33w6d

- Administer corticosteroids.
- Administer latency antibiotics and GBS prophylaxis, if indicated.
- Consider administration of a tocolytic for the first 48 hours if there is evidence of uterine contractions.
- If patient and fetus remain stable, delivery is recommended at 34 weeks.

Gestation at 23 - 32 Weeks

Gestation at 32w0d - 33w6d

Gestation at 34 Weeks+

34 Weeks +

- Delivery is recommended.
- If corticosteroids have not been administered previously in pregnancy, a single course can be administered; however, delivery should not be delayed for the administration of steroids.
- GBS prophylaxis is recommended if the patient's GBS status is unknown or positive.

- In the situation where there are no contraindications to labor and vaginal birth, most women will deliver by spontaneous or induced vaginal delivery [44].
- Cesarean delivery should be performed for standard indications.
- Digital cervical exam can safely be performed to plan approach to delivery.
- Oxytocin is administered for induction when the cervix is found to be favorable, according to standard protocols.
- Prostaglandins can be administered if cervical ripening is necessary.

Unfavorable cervix

- Fifteen randomized trials of women with term PROM underwent a meta-analysis and reported the rate of vaginal delivery in 12 and 24 hrs was similar after administration of misoprostol or oxytocin [45].
- Is it unknown whether misoprostol was advantageous in the subgroup of women with an unfavorable cervix since it was not evaluated.
- The optimum dose and route of misoprostol administration have not been determined.
- Prostaglandin E2 is a reasonable alternative [46].
- There is minimal information on the safety of mechanical methods of cervical ripening in PROM [47].

PPROM refers to rupture of fetal membranes prior to labor in pregnancies < 37 weeks 0 days.

PPROM is responsible for one-third of preterm births and occurs in three percent of pregnancies.

- PPROM risk increases three fold when PPROM has occurred in a prior pregnancy.
- PPROM is a clinical diagnosis based on visualizing amniotic fluid in the vagina of a women presenting with a history of leaking fluid.
- PPROM should be confirmed by visualizing or diagnostic testing while excluding other causes of vaginal discharge.

Click each box for more information.

Managing a women with PPROM is based on several factors:

- Gestational age
- Availability of NICU
- Presence or absence of maternal or fetal infection
- Presence or absence of labor or abruptio placentae
- Stability of fetal presentation and FHR tracing pattern
- Cervical status

Expeditious delivery of women with PPROM is clinically appropriate if intrauterine infection, abruptio placentae, nonreassuring fetal testing, or cord prolapse is present or suspected.

Click each box for more information.

For stable patients with PPROM < 34 weeks, expectant management is appropriate.

- Administer a course of antenatal corticosteroids to enhance fetal lung maturation in pregnancies less than 34 weeks.
- Prophylactic antibiotics with
  - Ampicillin 2g IV every 6 hours and erythromycin 250mg every 6 hours for 48 hours FOLLOWED by oral amoxicillin 250mg every 8 hours and erythromycin 333mg every 8 hours for five days.
  - Azithromycin 1g PO once at the time of admission and can be used if erythromycin is not available.
  - For women with a penicillin allergy recommended antibiotic therapy is a one time oral dose of azithromycin 1g and cefazolin 1g IV Q 8 hours for 48 hours, followed by cephalexin 500mg orally four times daily for five days.

1. ACOG Committee on Practice Bulletins - Obstetric. ACOG Practice Bulletin No. 160. Obstetrics & Gynecology: January 2016 -doi: 10.1097/AOG.0000000000001266

2. Rattray DD, O'Connel CM, Baskett TF. Acute disseminaqted intrqavascular coagulation in obstetrics: a tertiary centre population review (1980 to 2009). J Obstet Gynaecol Can 2012; 34:341.

3. Erez O, Novack L, Beer-Weisel R, et al. DIC score in pregnant women-- a population based modification of the International Society on Thrombosis and Hemostasis score. PLoS One 2014; 9:e93240.

4. Gilbers WM, Danielsen B. Amniotic fluid embolism: decreased mortality in a population-based study. Obstet Gynecol 1999; 93:973.

5. Bonnar J, Prentice CR, McNicol GP, Douglas AS. Haemostatic mechanism in the uterine circulation during placental separation. Br Med J 1970; 2:564.4.

6. Bonnar J, McNicol GP, Douglas AS. Coagulation and fibrinolytic mechanisms during and after normal childbirth. Br Med J 1970; 2:200.

7. Levi M. Disseminated intravascular coagulation (DIC) in pregnancy and the peri-partum period. Thromb Res 2009; 123 Supple2:263.

8. Takai H, Kondoh E, Sato Y, et al. Disseminated intravascular coagulation as the presenting sign of gastric cancer during pregnancy. J Obstet Gynaecol Res 2011; 37:1717.

9. Morimatsu Y, Matsubara S, Hirose N, et al. Acute promyelocytic leukemia: an unusual cause showing prolonged disseminated intravascular coagulation after placental abruption. Arch Gynecol Obstet 2008; 277:267.

10. Lockwood CJ, Murk W, Kayisli UA, et al. Progestin and thrombin regulate tissue factor expression in human term decidual cells. J Clin Endocrinol Metab 2009; 94:2164.

11. Lockwood CJ, Paidas M, Murk WK, et al. Involvement of human decidual cell-expressed tissue factor in uterine hemostasis and abruption. Thromb Res 2009; 124:516.

12. Hossain N, Paidas MJ. Disseminated intravascular coagulation. Semin Perinatol 2013; 37:257.

13. Gando S. Microvascular thrombosis and multiple organ dysfunction syndrome. Crit Care Med 2010; 38:S35.