TABLE OF CONTENTS

Anemia
Antibiotic Selection in Obstetrics
Antiphospholipid Syndrome
Cervical Insufficiency
Cesarean Delivery: Prevention of Infection
Chorioamnionitis
Corticosteroids to Enhance Fetal Lung Maturation
COVID-19 Infection
Cytomegalovirus Infection in Pregnancy
Depression
Diabetes
Endometritis
GBS Screening
Genetic Screening
Fetal Growth Restriction
Hepatitis
Herpes simplex Infections in Pregnancy
HIV Infection
Hyperemesis (Nausea and Vomiting of Pregnancy)
Hypertension
Induction of Labor
Influenza: Prevention and Treatment
Intrahepatic Cholestasis of Pregnancy
Mastitis
Oligohydramnios
Parvovirus Infection in Pregnancy
Placenta Previa
Placental Abruption
Placenta Accreta Spectrum
Polyhydramnios
Postcesarean Wound Infection
Postpartum Checklist
Postpartum Hemorrhage
Preeclampsia
Prenatal Care
Preterm Labor
Preterm Premature Rupture of Membranes
Shoulder Dystocia
Syphilis
Toxoplasmosis in Pregnancy
Trial of Labor After Cesarean
Tuberculosis Screening
Ultrasound in Pregnancy
Urinary Tract Infections
Vaccinations in Pregnancy
Vaginal Infections
Varicella in Pregnancy
OBSTETRICS MANAGEMENT PROTOCOLS

FOREWORD

The protocols in this booklet were written by members of the Division of Maternal-Fetal Medicine. Each author worked specifically in his or her area of expertise and clinical experience. These protocols are intended to provide practitioners with easy-to-read, evidence-based references that will inform the management of commonly encountered obstetric problems.

These protocols are suggested guidelines that should apply to the management of most patients. Individualization of care is always important, however, and, in some instances, deviations from the guidelines may be indicated.

Patrick Duff, M.D.
Editor
November 2021
DIAGNOSIS AND MANAGEMENT OF ANEMIA IN PREGNANCY

Patrick Duff, M.D.

EPIDEMIOLOGY

According to ACOG criteria, anemia is defined as a hemoglobin less than 11.0 g/dl in the first trimester, less than 10.5 g/dl in the second trimester, and less than 11.0 g/dl in the third trimester. The two most common causes of anemia in pregnancy are hemodilution and iron deficiency. Other important causes include:

• Folic acid deficiency
  o Alcoholism
  o Multiple gestation
  o Hemoglobinopathy
  o Extreme malnutrition
• Vitamin B 12 deficiency
  o Pernicious anemia
  o Vegan diet
  o Bariatric surgery
  o Celiac disease
  o Crohn’s disease
• Hemoglobinopathy
  o Alpha thalassemia
  o Beta thalassemia
  o Sickle cell and sickle cell/C disease
• Blood loss
  o Placenta previa
  o Placental abruption

CLINICAL MANIFESTATIONS

• Maternal
  o Fatigue
  o Pallor
  o Light-headedness
  o Tachycardia
  o Dyspnea
  o Poor exercise tolerance
  o Decreased work performance
  o Depressed mood

• Fetal/neonatal consequences
  o Increased perinatal mortality – associated with severe anemia
  o Low birth weight
- Preterm birth
- Fetal growth restriction
- Behavioral and neurodevelopmental abnormalities
# DIAGNOSIS AND MANAGEMENT

<table>
<thead>
<tr>
<th>CAUSE</th>
<th>DIAGNOSTIC TESTS</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemodilution</td>
<td>Decreased Hgb and HCT Normal RBC indices</td>
<td>None required other than routine iron supplement contained in the prenatal vitamin</td>
</tr>
<tr>
<td>Iron deficiency</td>
<td>Decreased Hgb and HCT Decreased MCV Decreased serum ferritin concentration</td>
<td>Additional oral iron supplement – ferrous sulfate, 325 mg twice daily or every other day *</td>
</tr>
<tr>
<td>Folic acid deficiency</td>
<td>Decreased Hgb and HCT Increased MCV Decreased serum folate concentration</td>
<td>Oral folic acid – 1 mg daily</td>
</tr>
<tr>
<td>Vitamin B12 deficiency</td>
<td>Decreased Hgb and HCT Increased MCV Decreased serum B12 concentration</td>
<td>Vitamin B12 orally, 1000 micrograms daily</td>
</tr>
<tr>
<td>Alpha thalassemia</td>
<td>Decreased Hgb and HCT DNA analysis</td>
<td>Daily prenatal vitamin plus supplemental iron and folic acid (as above)</td>
</tr>
<tr>
<td>Beta thalassemia</td>
<td>Decreased Hgb and HCT Hemoglobin electrophoresis</td>
<td>Daily prenatal vitamin plus supplemental iron and folic acid (as above)</td>
</tr>
<tr>
<td>Sickle cell and sickle cell/C disease</td>
<td>Decreased Hgb and HCT Hemoglobin electrophoresis</td>
<td>Daily prenatal vitamin plus supplemental iron and folic acid (as above) Transfusion if necessary</td>
</tr>
<tr>
<td>Blood loss</td>
<td>Decreased Hgb and HCT Decreased serum ferritin concentration – depending upon acute versus chronic blood loss</td>
<td>Daily prenatal vitamin plus supplemental iron and folic acid (as above) Transfusion if necessary</td>
</tr>
</tbody>
</table>

Hgb – hemoglobin  
HCT – hematocrit  
RBC – red blood cell  
MCV – mean corpuscular volume  

*Reserve intravenous iron only for patients who fail to respond to oral iron supplements. See enclosed guidelines for ordering intravenous iron through the Infusion Center.  
REFERENCE  
November 2021
PROTOCOL FOR IRON INFUSION TREATMENTS FOR OBSTETRIC PATIENTS

KEY CONTACTS IN THE DIVISION OF HEMATOLOGY

- Dr. Carol Matthew – special interest in hematologic disorders in pregnancy
- Dr. Anita Rajasekhar – senior consultant
- Barbara Pesata, RN (Charge Nurse in Infusion Center) x 50720

PRINCIPAL INDICATION FOR INTRAVENOUS IRON INFUSION

- Iron-deficiency anemia (low MCV, low serum ferritin) combined with poor response to oral iron supplementation or patient intolerance of oral iron

PRINCIPAL CONTRAINDICATIONS FOR INTRAVENOUS IRON INFUSION

- Prior history of allergic/anaphylactic reaction to intravenous iron
- Hypotension
- Hemosiderosis
- Hemochromatosis
- Anemia which will not be responsive to iron, e.g., sickle cell anemia, beta thalassemia

SITE FOR INTRAVENOUS IRON INFUSION

- ADULT INFUSION CENTER IN THE MEDICAL PLAZA OFFICE BUILDING

METHOD FOR ORDERING THE INFUSION

- Open an “orders only” encounter in EPIC
- Look for the tab at the top of the screen that says “General Therapy Plan.” If you don’t already have this on your desktop, find the “wrench” to the right of the tabs and locate “General Therapy Plan” in the list of options. It should be about halfway down the column. Click and drag this option to your sequence of tabs at the top of the page.
Under “General Therapy Plan,” enter “Venofer.” This entry identifies the type of iron we wish to infuse, which is iron sucrose. Be careful not to order “iron dextran.” This is the preparation which is much more likely to cause an allergic reaction.

Click on the “start date” and enter the date you wish to start the infusion sequence.

In the box that says, “Treatment Department,” click on UF Adult Infusion.

You will be asked to specify the diagnoses. Along with “high risk pregnancy,” be sure to indicate “severe iron deficiency.” The Infusion Center cannot be compensated if we only list obstetric diagnoses.

Then, click on “Assign Plan.” The plan for “Adult iron sucrose infusion” will then auto populate.

Unclick the orders for the pre-medications. As a general rule, these medications should not be necessary for this type of low-risk iron infusion.

Specify the dose of iron – typically 500 mg.

Indicate that you want the infusion administered weekly, typically over 3 to 4 weeks to a maximum total dose of 1.5 to 2.0 grams.

Indicate that the infusion can be given any day of the week because this notation will increase the flexibility of scheduling.

The 500 mg dose of intravenous iron will be administered over 3.5 hours. Lower doses take less time to administer. Patients need to realize that they must commit about a half day to this treatment.

Once all this information is entered, click “Accept.”

Then, sign the encounter.

After you sign the encounter, you will be asked to review your orders and approve them again by entering your EPIC password.

Once you have completed your data entry, someone from the Infusion Center will call the patient to schedule the first appointment and to verify the patient’s insurance company will cover the infusion.

Have the patient sign the consent form for the iron infusion. Then, have the nursing assistant scan the consent into the Media section of EPIC. Label the document “Iron Infusion Consent.”
I, the undersigned, consent to the following infusion therapy(ies): IV iron

to be performed and administered under the direction of Dr. _______________ and his/her associates and assistants (including resident physicians and nurses), with knowledge that the attending physician will have primary responsibility for my care specific to the stated procedure.

Dr. _______________ has explained to me the nature and purpose of each procedure(s) as well as the substantial risks and possible complications involved, the benefits and the medically reasonable alternative methods of treatment.

I understand that I will require repeated cycles of medication for treatment not to exceed one year and that the risks listed below are present each time the treatment is done. I consent to receiving repeated cycles of the medication(s) as either an inpatient at UF Health Shands Hospital, or an outpatient at the UF Health Infusion Center – Medical Plaza or UF Health Shands Transplant Center – Bone Marrow Transplant Unit. I understand that I have the right to rescind this consent at any time during the course of medical treatment.

The SUBSTANTIAL RISKS include but are not limited to:

greater than 10% = flushing; dizziness; fever; headache; pain; nausea; vomiting; metallic taste; diaphoresis
1% - 2% = hypertension; urticaria; phlebitis; diarrhea; discoloration of urine
less than 1% = anaphylactic reaction; anaphylaxis; shock; death

The POTENTIAL BENEFIT(S) include but are not limited to: improved symptoms of anemia, such as fatigue, shortness of breath, and light-headedness; increased hemoglobin and hematocrit

The MEDICALLY REASONABLE ALTERNATIVE(s) options are: oral iron or alternative IV iron preparation; blood transfusion

• I understand that the information I have received, about risks is not exhaustive and there may be other, more remote risks.
• I have had the opportunity to ask questions regarding the proposed treatment(s) and all my questions have been answered to my satisfaction.
• I have read or have had read to me, this Informed Consent form.
• I have had explained to me and I understand the potential benefits and drawbacks, potential problems related to recuperation, the likelihood of success, the possible results of non-treatment, and any medically reasonable alternatives.
• I have received no guarantees from anyone regarding the results that may be obtained.
• I know the relationship, if any, of my physician or other practitioner, to any teaching facility involved in my care.

UFHealth

SHANDS

The form provided by UF Health Shands as a courtesy to physicians and their patients.

If printed electronically, pages 1 & 2 must be stapled.

Informed Consent for Treatment:
Infusion Center (page 1 of 2)
## ANTIBIOTICS COMMONLY USED IN OBSTETRICS

**Patrick Duff, M.D.**

<table>
<thead>
<tr>
<th>ANTIBIOTIC</th>
<th>USUAL INDICATION</th>
<th>PRINCIPAL ADVERSE EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin or ampicillin</td>
<td>Group A streptococcal infection</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td></td>
<td>Chlamydia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GBS</td>
<td></td>
</tr>
<tr>
<td></td>
<td>UTI</td>
<td></td>
</tr>
<tr>
<td>Amoxicillin-sulbactam (Unasyn)</td>
<td>Chorioamnionitis</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td></td>
<td>Endometritis</td>
<td></td>
</tr>
<tr>
<td>Azithromycin</td>
<td>Bronchitis</td>
<td>GI upset</td>
</tr>
<tr>
<td></td>
<td>Chlamydia</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Otitis media</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sinusitis</td>
<td></td>
</tr>
<tr>
<td>Aztreonam</td>
<td>Endometritis – in combination with clindamycin</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td></td>
<td>Pyelonephritis</td>
<td></td>
</tr>
<tr>
<td>Cefazolin</td>
<td>Prophylaxis for cesarean delivery</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td></td>
<td>Staphylococcal infection</td>
<td></td>
</tr>
<tr>
<td>Cefepime, cefotetan, cefoxitin</td>
<td>Endometritis</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>Gonorrhea</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td></td>
<td>Pyelonephritis</td>
<td></td>
</tr>
<tr>
<td>Clindamycin</td>
<td>Bacterial vaginosis</td>
<td>Diarrhea</td>
</tr>
<tr>
<td></td>
<td>Endometritis – in combination with gentamicin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mastitis</td>
<td></td>
</tr>
<tr>
<td>Gentamicin (amikacin)</td>
<td>Endometritis – in combination with clindamycin</td>
<td>Nephrotoxicity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ototoxicity</td>
</tr>
<tr>
<td>Macrodantin</td>
<td>UTI</td>
<td>GI upset</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>Bacterial vaginosis</td>
<td>Antabuse-like effect when taken with alcohol</td>
</tr>
<tr>
<td></td>
<td>Endometritis – in combination with ampicillin and gentamicin</td>
<td></td>
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<tr>
<td></td>
<td>Giardiasis</td>
<td></td>
</tr>
<tr>
<td>Penicillin</td>
<td>GBS</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td></td>
<td>Oral infection</td>
<td></td>
</tr>
<tr>
<td>Piperacillin-tazobactam (Zosyn)</td>
<td>Chorioamnionitis</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td></td>
<td>Endometritis</td>
<td></td>
</tr>
<tr>
<td>Sodium dicloxacillin</td>
<td>Mastitis</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td></td>
<td>Staphylococcal skin infection</td>
<td></td>
</tr>
<tr>
<td>Trimethoprim-sulfamethoxazole</td>
<td>Mastitis</td>
<td>GI upset</td>
</tr>
<tr>
<td></td>
<td>UTI</td>
<td>Hypersensitivity reaction</td>
</tr>
<tr>
<td></td>
<td>Wound infection</td>
<td></td>
</tr>
<tr>
<td>Vancomycin</td>
<td>GBS in penicillin-allergic patient</td>
<td>Allergic reaction</td>
</tr>
<tr>
<td></td>
<td>Staphylococcal wound infection</td>
<td></td>
</tr>
</tbody>
</table>
<pre><code>                            |                                                                                 | Nephrotoxicity                                                 |
                            |                                                                                 | Ototoxicity                                                    |
</code></pre>
# Antibiotic Selection for Common Infections in Pregnancy

Patrick Duff, M.D.

<table>
<thead>
<tr>
<th>Infection</th>
<th>Usual Antibiotic Treatment</th>
</tr>
</thead>
</table>
| **Acute cystitis and asymptomatic bacteriuria** | **First trimester**  
Amoxicillin (875 mg p.o. BID x 7d)  
Cephalexin (500 mg p.o. TID x 7d)  
**Second and third trimester**  
Macrodantin (100 mg p.o. BID x 7d)  
Trimethoprim-sulfamethoxazole (one DS tablet p.o. BID x 7d) |
| **Bacterial vaginosis**           | Metronidazole (500 mg p.o. BID x 7d)  
Clindamycin (300 mg p.o. BID x 7d) |
| **Candidiasis**                   | **First trimester**  
Clotrimazole cream (nightly x 1 week)  
Miconazole cream (nightly x 1 week)  
**Second and third trimester**  
Fluconazole (150 mg p.o. on day 1, repeat on d 3) |
| **Chorioamnionitis** *            | Ampicillin (2 grams I.V. q 6 h) plus Gentamicin (5 mg/kg/IBW q 24 h)  
Add metronidazole (500 mg IV x 1) if patient delivers by cesarean |
| **Chlamydia**                     | Azithromycin (1000 mg p.o. x 1) |
| **Endometritis** **              | Clindamycin (900 mg IV q 8h) plus gentamicin (5 mg/kg/IBW q 24h)  
**OR**  
Ampicillin-sulbactam (3 grams IV Q 6h)  
Cefepime (2 grams IV q8h)  
Cefoxitin (2 grams IV Q 8h)  
Cefotetan (2 grams IV Q 12h)  
Imipenem-cilastatin (500 mg IV Q 6h)  
Meropenem (1 gram Q 8h)  
Piperacillin-tazobactam (3.375 grams IV Q 6h) |
| **Gonorrhea**                     | Ceftriaxone (500 mg IM x 1)  
**OR**  
Cefixime (800 mg p.o. x 1) |

*Administer a single dose of each antibiotic at the appropriate interval postpartum.  
**Treat until patient has been asymptomatic and afebrile x 24 h.
<table>
<thead>
<tr>
<th>INFECTION</th>
<th>ANTIBiotic TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Herpes simplex</td>
<td>Acyclovir (400 mg p.o. TID for 5 to 10 d, depending upon severity of the infection)</td>
</tr>
<tr>
<td></td>
<td>Valacyclovir (1000 mg p.o. BID for 5 to 10 d, depending upon severity of the infection)</td>
</tr>
<tr>
<td>Pyelonephritis</td>
<td>Ceftriaxone (2 grams IV Q 24h) initially until afebrile and asymptomatic. THEN</td>
</tr>
<tr>
<td></td>
<td>Amoxicillin-clavulanate (875 mg p.o. BID x 7d) or trimethoprim-sulfamethoxazole</td>
</tr>
<tr>
<td></td>
<td>(one DS tablet p.o. BID x 7d)</td>
</tr>
<tr>
<td>Syphilis</td>
<td><strong>Primary, secondary, or early latent</strong></td>
</tr>
<tr>
<td></td>
<td>Benzathine penicillin G (2.4 million units IM x 1)</td>
</tr>
<tr>
<td></td>
<td><strong>Late latent, undetermined duration, and tertiary</strong></td>
</tr>
<tr>
<td></td>
<td>Benzathine penicillin G (2.4 million units IM weekly x 3)</td>
</tr>
<tr>
<td></td>
<td><strong>Neurosyphilis</strong></td>
</tr>
<tr>
<td></td>
<td>Aqueous crystalline penicillin G (3-4 million units IV q 4h x 10-14d) OR</td>
</tr>
<tr>
<td></td>
<td>Procaine penicillin (2.4 million units IM daily, plus probenecid (500 mg p.o.</td>
</tr>
<tr>
<td></td>
<td>4 times daily), both for 10-14d</td>
</tr>
<tr>
<td>Trichomonas</td>
<td>Metronidazole (500 mg p.o. BID x 7d)</td>
</tr>
<tr>
<td>Wound infection</td>
<td><strong>Inpatient</strong></td>
</tr>
<tr>
<td></td>
<td>Clindamycin (900 mg IV Q 8h) plus gentamicin (5 mg/kg/IBW Q 24h) plus vancomycin (1</td>
</tr>
<tr>
<td></td>
<td>gram IV Q 12h)</td>
</tr>
<tr>
<td></td>
<td><strong>Outpatient</strong></td>
</tr>
<tr>
<td></td>
<td>Amoxicillin-clavulanate (875 mg p.o. BID) x 7–10d) OR</td>
</tr>
<tr>
<td></td>
<td>Trimethoprim-sulfamethoxazole (one DS tablet p.o. BID x 7-10 d)</td>
</tr>
</tbody>
</table>

**REFERENCE**

December 2021
ANTIPHOSPOLIPID SYNDROME

Patrick Duff, M.D.

DEFINITION
• Autoimmune disorder defined by characteristic clinical features and specific circulating antiphospholipid antibodies
• Associated with an increased risk for thromboembolism, both venous and arterial
• Also associated with an increased risk for adverse pregnancy outcome

RISK FACTORS – Patients with any of the following complications in the current or a prior pregnancy should be tested for APLS
• Recurrent pregnancy loss
• Intrauterine fetal death – not otherwise explained
• Severe fetal growth restriction (FGR) – not otherwise explained
• Early onset pre-eclampsia (before 34 weeks) with severe features
• Unprovoked VTE event, particularly an arterial thrombus or a venous or arterial thrombus in an unusual blood vessel (e.g., upper extremity)
• Co-existing SLE

DIAGNOSIS
• Two positive antiphospholipid antibody test results at least 12 weeks apart
  • Lupus anticoagulant
  • Anticardiolipin antibody – IgG and IgM
  • Anti-beta-2 glycoportein I antibody – IgG and IgM

OBSTETRIC MANAGEMENT
• First trimester ultrasound to confirm viability and establish accurate dating
• Non-invasive prenatal screening
• Comprehensive anatomic survey at 20-22 weeks
• Follow up assessments for FGR at 28 weeks and 32-34 weeks
• Weekly antenatal testing beginning at 32-34 weeks. Testing should begin at 28 weeks if FGR is present.
• Testing should include NST and assessment of AFI.
• Umbilical artery Doppler should be performed if FGR is present.
• The patient should receive low-dose aspirin (81–162 mg) throughout pregnancy.
• The patient also should receive prophylactic anticoagulation with enoxaparin (Lovenox) throughout pregnancy and for 6 weeks postpartum. Some patients may require lifetime prophylactic anticoagulation, depending upon the recommendation from the Hematology consultant.
• The dose of enoxaparin should be 40 mg subcutaneously each day. If the patient has a particularly strong history of VTE, the dose of enoxaparin should be 40 mg subcutaneously twice daily. Patients receiving prophylactic doses of enoxaparin do not require any laboratory monitoring.

• If the patient experiences a VTE event during the pregnancy, she should receive therapeutic anticoagulation. In this situation, the dose of enoxaparin should be 1.5 mg/kg subcutaneously once daily or 1 mg/kg twice daily.
• Delivery should normally occur at 37–39 weeks, depending upon the presence or absence of FGR and the presence or absence of reassuring antenatal testing.

REFERENCE


January 2022
CERVICAL INSUFFICIENCY

Patrick Duff, M.D.

EPIDEMIOLOGY

*Cervical insufficiency is characterized by spontaneous delivery in the early to mid-second trimester. Patients typically experience spontaneous rupture of membranes, sometimes accompanied by bleeding and contractions, and then rapidly deliver.

*The principal risk factors for cervical insufficiency include, but are not limited to:
  * Prior history of vaginal delivery complicated by a cervical laceration
  * Prior history of LEEP
  * Prior history of conization
  * Prior history of spontaneous preterm delivery, especially at an early gestational age
  * Uterine anomalies
  * Exposure of the patient’s mother to DES (diethystilbesterol) while carrying the patient in-utero. This medication was originally used in patients who were experiencing a threatened abortion. Subsequently, it was proven to be ineffective in preventing miscarriage. Moreover, it caused structural abnormalities in the lower genital tract in exposed fetuses.

DIAGNOSIS

* The diagnosis may be made on the basis of the patient’s history of early to mid-second trimester delivery, as outlined above.

* The diagnosis also may be made on the basis of ultrasound identification of a shortened cervical length (< 25 mm) with, or without, funneling of the membranes into the cervical canal.

MANAGEMENT

* Patients who have a clear history of “classic incompetent cervix” should be scheduled for a cerclage procedure at 13-14 weeks gestation.

* Prior to the procedure, NIPS and a first-trimester screening ultrasound examination should be performed.

* When the diagnosis is established by ultrasound, the procedure should be scheduled as quickly as possible after the diagnosis is made. A normal fetal karyotype should be documented by NIPS, and a screening ultrasound examination should exclude a major fetal anomaly that might make a cerclage contraindicated.

* Two types of transvaginal cerclage procedures are performed at this institution. They may be performed under either regional or general anesthesia.

  * One procedure is the McDonald Cerclage. The purse string suture is placed just below the bladder reflection and just below the internal cervical os. The knot is tied
at the 12-1 o’clock position. Either #1-Novofil or a 5 mm Mersilene band is used for this procedure.

*The second procedure is a modification of the Shirodkar Cerclage. In this operation, the bladder reflection is dissected upward, and the suture is placed at the level of the internal cervical os. The knot is tied at the 12-1 o’clock position. The 5 mm Mersilene band is usually used for this procedure. Unlike the original Shirodkar procedure, this modified procedure does not require the dissected mucosa to be sewn over the suture knot, and the suture can be removed prior to delivery. In the original procedure, the suture was left in place, and the patient was delivered by cesarean.

<table>
<thead>
<tr>
<th>SUTURE</th>
<th>ADVANTAGE</th>
<th>DISADVANTAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novovil</td>
<td>Minimal coefficient of drag</td>
<td>May tear through tissue more easily as pregnancy progresses</td>
</tr>
<tr>
<td></td>
<td>Easier to insert</td>
<td></td>
</tr>
<tr>
<td>Mersilene band</td>
<td>Broad-based, less likely to tear through tissue</td>
<td>High coefficient of drag</td>
</tr>
<tr>
<td></td>
<td>More difficult to insert</td>
<td></td>
</tr>
</tbody>
</table>

* At the time of surgery, the patient should receive a 2-gram dose of cefazolin to provide prophylaxis against infection. She also should receive oral indomethacin, 25 mg every 6 hours for 48 hours. Subsequently, she should be placed on intravaginal micronized progesterone (Prometrium, 200 mg) each night.

* The cerclage is normally removed at 36-37 weeks. In most instances, the removal can be accomplished in the outpatient clinic. However, if visibility is poor and/or the patient is extremely uncomfortable, the removal should be completed in Labor and Delivery where anesthesia can be administered and good lighting and adequate retraction are more accessible.

* If the patient experiences preterm labor that does not respond promptly to tocolysis, the cerclage should be removed at the time progression in labor appears to be inevitable. In most instances, the cerclage should be removed if the patient experiences preterm premature rupture of membranes.

* In highly selected circumstances, where placement of the cerclage may be unusually difficult, or where the patient declines surgery, positioning of a cervical pessary may be an acceptable alternative.

* Some patients with an extremely short cervix may be candidates for an abdominal cerclage. This procedure is usually performed laparoscopically (consult with Dr. Moawad)

REFERENCE


January 2022
PREVENTION OF INFECTION FOLLOWING CESAREAN DELIVERY

Patrick Duff, M.D.

EPIDEMIOLOGY

Infection is the most common complication following cesarean delivery. The two major infections are endometritis and wound infection (surgical site infection). The frequency of each of these infections varies with the patient population, the type of cesarean (scheduled versus unscheduled), the surgical techniques employed, and the consistency with which prophylactic antibiotics are used.

The most important risk factors for endometritis are socioeconomic status of the patient, duration of labor, duration of ruptured membranes, number of internal vaginal examinations after rupture of membranes, duration of internal fetal monitoring, and the presence of co-existing infections such as bacterial vaginosis and group B streptococcal colonization. The principal risk factors for wound infection are obesity, diabetes, smoking, duration of surgery, blood loss, and closure technique.

PREVENTION OF ENDOMETRITIS

The following interventions are based on Level I evidence and merit a Level A recommendation.

- Administer prophylactic antibiotics within the hour prior to surgery.
  - Cefazolin – 2 grams IV given as a bolus prior to surgery
  - Azithromycin – 500 mg IV given as an infusion over one hour prior to surgery
- Cleanse the vaginal canal with a solution of povidone-iodine just prior to surgery.
- Remove the placenta by traction on the umbilical cord rather than by manual extraction.
PREVENTION OF WOUND INFECTION (SURGICAL SITE INFECTION)

The following interventions are based on Level I evidence and merit a Level A recommendation.

- Administer prophylactic antibiotics within the hour prior to surgery, as noted above.
- Prepare the surgical site by clipping, rather than shaving, the hair and by scrubbing the skin with chlorhexidine.
- Close the deep subcutaneous layer (if greater than 2 cm in thickness) with a resorbable suture such as 3-0 Vicryl.
- Close the skin with a subcutaneous monofilament suture.
- In patients at significantly increased risk for wound infection (e.g., high BMI), apply a negative pressure wound dressing.

REFERENCE

DIAGNOSIS AND MANAGEMENT OF CHORIOAMNIONITIS

Patrick Duff, M.D.

EPIDEMIOLOGY

Chorioamnionitis (inflammation/infection of the chorioamniotic membranes) is also known as intra-amniotic infection. It occurs in approximately 3 to 5% of term patients and in up to 25% of preterm patients. It is an important cause of preterm PROM and preterm labor. It may be associated with neonatal sepsis, pneumonia, meningitis, and cerebral palsy, especially in preterm infants.

The infection is polymicrobial:
- Anaerobic gram-positive cocci
  - Peptococci and Peptostreptococci species
- Anaerobic gram-negative bacilli
  - Bacteroides and Prevotella species
- Aerobic gram-negative bacilli
  - Predominantly E.coli, Klebsiella pneumoniae, and Proteus species
- Aerobic gram-positive cocci
  - Group B streptococci
  - Enterococci
  - Staphylococci species

The principal risk factors for chorioamnionitis are:
- Extended duration of labor
- Extended duration of ruptured membranes
- Multiple vaginal examinations following rupture of membranes
- Pre-existing genital tract infection (BV) or colonization (GBS)
- Internal fetal monitoring

CLINICAL MANIFESTATIONS

- Maternal fever in the absence of any other localizing finding
- Maternal tachycardia
- Uterine tenderness
- Fetal tachycardia and diminished variability
- Purulent amniotic fluid (rare finding)

DIAGNOSIS

- Usually based on the clinical findings outlined above
- Amniocentesis may be helpful in confirming the diagnosis, especially in patients in preterm labor
  - Positive gram stain
  - Positive leukocyte esterase
  - Positive nitrites
- Low amniotic fluid glucose (< 20 mg/dl)
- Culture
TREATMENT

Establish diagnosis

Treat immediately with ampicillin (2 grams IV q 6 h) plus gentamicin (5mg/kg IBW q 24 h)

Alternative agents include piperacillin plus tazobactam (3.375 grams Q 6 h) or ampicillin-sulbactam (3.0 grams q 6 h)

The alternative agents are specifically indicated in any patient with impaired renal function.

If vaginal delivery, administer one dose of each drug at the appropriate interval postpartum. Then, discontinue antibiotics.

If cesarean delivery, administer metronidazole (500 mg IV) immediately after cord is clamped and, subsequently, an additional dose of ampicillin and gentamicin postpartum. Then, discontinue antibiotics.

If patient is high risk (BMI >30 or ROM > 24h), continue antibiotics until patient is afebrile and asymptomatic for 24 h.

REFERENCE

CORTICOSTEROIDS TO ENHANCE NEONATAL OUTCOME IN PRETERM DELIVERIES

RATIONALE

Corticosteroids are of value in reducing the frequency and severity of several major complications of prematurity:

- Respiratory distress syndrome
- Intraventricular hemorrhage
- Necrotizing enterocolitis
- Neonatal sepsis

The overall effect is a reduction in the risk of neonatal mortality.

INDICATIONS

With the exceptions noted below, corticosteroids should be administered to all patients who are at high risk of preterm birth within 7 days of initial assessment.

CONTRAINDICATIONS

- Patient is expected to deliver in less than 12 hours
- Life-threatening fetal anomaly
- Uncontrolled diabetes

PRECAUTIONS

- Be wary of use of corticosteroids even in patients with seemingly well-controlled diabetes because these drugs may exacerbate the risk of neonatal hypoglycemia.
- If indicated, use tocolytics to forestall delivery for 48 hours.
  - If the gestational age is < 32 weeks, magnesium sulfate is the tocolytic of choice
  - If the gestational age is > 32 weeks, nifedipine is the tocolytic of choice
TREATMENT REGIMENS

- The preferred treatment regimen is intramuscular betamethasone, 12 mg every 24 hours for 2 doses.
- An acceptable alternative regimen, if betamethasone is not available, is intramuscular dexamethasone, 6 mg every 12 hours for 4 doses.
- The optimal effect of glucocorticoid administration occurs 48 hours or more beyond the first dose.
- Some benefit still occurs after 24 hours.
- In patients who receive the first course of betamethasone before 28 weeks gestation and who, again, present with a high risk of imminent preterm delivery, a “rescue dose” of glucocorticoids should be administered, unless contraindicated.

References


November 2021
COVID-19 INFECTION: BACKGROUND INFORMATION

Patrick Duff, M.D.

EPIDEMIOLOGY

• Pathogen is SARS-CoV-2, a novel coronavirus
• Virus is genetically similar to the viruses that cause SARS and MERS
• Transmitted by respiratory droplets and by aerosolization
  o Spike protein of virus attaches to ACE receptors which are present in the alveolar epithelium and placenta
  o These receptors become down-regulated, resulting in excessive production of angiotensin-II
  o Angiotensin-II interacts with angiotensin-1 receptor, leading to increased production of IL-6, TNF-alpha, IL-16, and IL-10
    → increased pulmonary vascular permeability and severe lung injury
• Transmission from environmental surfaces is uncommon
• Principal risk factors
  o Older age
  o Obesity
  o Hypertension
  o Diabetes
  o Underlying cardiopulmonary disease
  o Immunosuppressive disorder

CLINICAL MANIFESTATIONS

• Asymptomatic or mild illness (80% of patients)
  o Fever
  o Myalgias
  o Arthralgias
  o Sore throat
  o Lack of taste and smell
  o Non-productive cough
  o Dyspnea
  o Diarrhea

• Severe illness (20% of patients)
  o Severe dyspnea
  o Pneumonia
  o ARDS
  o Multiorgan failure
  o Septic shock

DIAGNOSIS

• PCR
  o Nasopharyngeal swab
• Saliva
• CT scan of the lung – ground-glass opacities

EFFECTS ON PREGNANCY
• Compared to non-pregnant patients, pregnant women are not necessarily more likely to acquire infection
• However, if infected, pregnant women are more likely to become seriously ill
• No definitive evidence of teratogenicity
• Increased risk of preterm delivery – usually for maternal illness
• Increased frequency of cesarean delivery – usually because of maternal deterioration
• Increased risk of NICU admission
• Perinatal transmission risk is 3.2% (95% CI 2.2 – 4.3%)

MANAGEMENT
• Asymptomatic patient or mild illness
  • Isolation for minimum of 5 days, depending upon the viral variant
  • Optimal nutrition and hydration
  • Adequate rest
  • Acetaminophen for analgesia
    • Maximum – 3000 mg/24 hours
  • Nirmatrelvir + ritonavir (Paxlovid, Pfizer)
    • Ideally, should be given within 48 hours of onset of symptoms
    • Reduces hospitalization or death by 89%
  • Monoclonal antibodies are not effective against the omicron variant, which is now the dominant strain in the U.S.
• Severe or critical illness (mainstays of therapy)
  • Hospitalization
  • Treatment of secondary bacterial infection if present
  • Respiratory support
  • Enoxaparin (Lovenox) for prevention of VTE
  • Remdesivir
    • 200 mg IV x 1, then 100 mg IV every 24 hours x 4 days
  • Dexamethasone
    • 6 mg IV or PO x 10 days or until hospital discharge

PREVENTIVE MEASURES
• Avoidance of crowded indoor or outdoor venues
• Physical distancing
• Mask
  • Surgical mask
  • KN95 mask
  • N95 mask
Cloth masks, visors, and bandanas are much less effective in preventing viral transmission.

- Vaccination
  - Johnson & Johnson
    - One dose plus booster of any of the three approved vaccines after 2 months
  - Moderna
    - Two doses separated by 4 weeks plus booster 6 months after second dose
  - Pfizer
    - Two doses separated by 3 weeks plus booster 5 months after second dose
  - Immunocompromised patients should receive a third primary dose of the Moderna or Pfizer vaccine 28 days after the second dose, followed by the booster dose in 5 months (Pfizer) or 6 months (Moderna)

REFERENCES

1. MMWR, November 6, 2020.

January 2022
CYTOMEGALOVIRUS (CMV) INFECTION IN PREGNANCY

Patrick Duff, M.D.

EPIDEMIOLOGY

CMV is a DNA virus that is a member of the herpes virus family. Like other members of the herpes virus family, CMV may remain latent in host cells after the initial infection. Recurrent infection is usually caused by reactivation of an endogenous latent virus rather than by reinfection from a new viral strain.

Horizontal transmission occurs as a result of close personal contact, e.g., between toddlers in day care who handle toys that are contaminated by infected saliva and urine and between mothers and infected children. Transmission also can occur from sexual contact. Vertical transmission may result from transplacental transmission, transmission during delivery, and transmission from breastfeeding.

The greatest risk of congenital infection occurs when the mother develops an acute primary CMV infection in the first half of pregnancy. In this setting, approximately 5 to 15% of neonates are symptomatic at birth. Approximately 30% of these infants die, and most of the survivors have major long-term morbidity. Of those who are asymptomatic at birth, 10 to 15% will subsequently develop hearing loss, visual deficits, or dental defects in the first two years of life. When primary infection occurs in the second half of pregnancy, less than 2% of neonates have evidence of severe injury. In the setting of recurrent CMV infection in pregnancy, very few neonates will show evidence of injury at birth; some will develop sequelae such as hearing and visual deficits, developmental delays, and learning disabilities, in early childhood.

CLINICAL MANIFESTATIONS

Most immunocompetent children and adults with CMV infection are asymptomatic. When symptoms are present, they resemble a severe flu-like illness. Immunocompromised individuals may develop manifestations such as chorioretinitis and severe pneumonia.
The characteristic manifestations of congenital CMV infection are those of the "blueberry muffin baby."

- Growth restriction
- Microcephaly
- Ventriculomegaly
- Chorioretinitis
- Hepatosplenomegaly
- Hepatitis
- Thrombocytopenia
- Purpuric skin lesions

**DIAGNOSIS OF ACUTE MATERNAL INFECTION**

- Positive IgM antibody
- If both IgM and IgG antibody tests are positive, IgG avidity should be obtained. "Low avidity" is characteristic of acute infection. "High avidity" is indicative of recurrent infection.
- Positive CMV PCR in serum
- Positive CMV culture in serum

**DIAGNOSIS OF CONGENITAL INFECTION**

- Amniocentesis – identification of CMV in amniotic fluid by PCR or culture
  - First procedure may be performed as early as 15-16 weeks
  - If the initial test is negative, the procedure should be repeated in 4 to 6 weeks
- Characteristic ultrasound findings
  - Fetal growth restriction
  - Microcephaly
  - Ventriculomegaly
  - Periventricular calcifications
  - Serous effusions
  - Hepatomegaly
  - Echogenic bowel
MANAGEMENT

- At the present time, there is no commercially available CMV vaccine that is highly effective.
- Treatment of infection in the mother is rarely indicated unless the patient is immunocompromised.
- When the fetus is severely injured, pregnancy termination may be an option depending upon gestational age and the desires of the parents.
- There is no therapy that is consistently effective in preventing, or ameliorating the severity of, congenital infection.
  - The initial promising results of treatment with CMV-specific antibody have not been sustained in large prospective randomized trials.
  - One therapy that has shown modest effectiveness is treatment of the mother with high doses of oral valacylovir, 2 grams four times daily.
    - Achieves therapeutic concentrations of drug in fetal blood
    - Decreases viral load in fetal blood
    - Increases the proportion of asymptomatic neonates

REFERENCES


November 2021
DIAGNOSIS AND MANAGEMENT OF DEPRESSION DURING PREGNANCY AND THE Puerperium

Patrick Duff, M.D.

EPIDEMIOLOGY

Up to 20% of pregnant and postpartum patients will develop depression of varying severity. The principal risk factors for depression during, or immediately after, pregnancy include:

- History of depression and/or anxiety in a family member
- Previous personal history of depression, especially in a prior pregnancy
- History of premenstrual dysphoric disorder
- Younger age
- Lower socioeconomic status - housing and food insecurity
- Poor social support system
- History of substance abuse
- Ambivalence about the pregnancy

CLINICAL MANIFESTATIONS

- Sadness
- Irritability
- Anger
- Psychomotor retardation
- Loss of interest in usual pleasurable activities
- Sexual dysfunction – particularly loss of libido
- Sleep disturbance
  - Difficulty falling asleep
  - Early-morning wakefulness
- Appetite disturbance
  - Decreased appetite with associated weight loss
  - Binge eating with associated weight gain
- Suicidal ideation
- Homicidal ideation
- Disheveled personal appearance
- Neglect of the newborn infant
- Physical injury to the newborn infant
DIAGNOSIS

The diagnosis of depression is usually made on the basis of the mental status examination. Particularly in the postpartum period, hypothyroidism can cause many of the symptoms outlined above, so thyroid function tests should be performed. In addition, bipolar disease must be excluded before beginning treatment for depression.

TREATMENT

- Patients who are clearly psychotic should be immediately referred to the Psychiatry Service for admission.
- Patients who clearly pose a danger to themselves or others (partner, newborn) should be immediately referred to the Psychiatry Service for admission.
- Patients with severe psychomotor retardation should also be referred for admission. These individuals may benefit from immediate management with electroconvulsive therapy (ECT). ECT is safe for use in pregnancy.
- Patients with milder forms of depression such as the “postpartum blues” can often be treated successfully with counseling alone.
- The majority of patients, however, will benefit from both counseling and antidepressant medication. Commonly used drugs are listed in the table.

<table>
<thead>
<tr>
<th>DRUG</th>
<th>STARTING DOSE</th>
<th>RANGE IN DAILY DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bupropion</td>
<td>75 mg</td>
<td>75 – 300 mg</td>
</tr>
<tr>
<td>Citalopram (SSRI)</td>
<td>10 mg</td>
<td>10 – 40 mg</td>
</tr>
<tr>
<td>Escitalopram (SSRI)</td>
<td>10 mg</td>
<td>10 – 20 mg</td>
</tr>
<tr>
<td>Fluoxetine (SSRI)</td>
<td>10 mg</td>
<td>10 – 60 mg</td>
</tr>
<tr>
<td>Mirtazapine</td>
<td>15 mg</td>
<td>15 – 45 mg</td>
</tr>
<tr>
<td>Sertraline (SSRI)</td>
<td>50 mg</td>
<td>100 – 150 mg</td>
</tr>
<tr>
<td>Venlafaxine (SNRI)</td>
<td>75 mg</td>
<td>75 – 225 mg</td>
</tr>
</tbody>
</table>
* There is no definitive evidence of birth defects associated with use of any of these medications in pregnancy. Some infants will have a transient and self-limited neonatal adaptation syndrome characterized by poor feeding, poor tone, and irritability. Less than 1% of infants exposed to SSRIs will have persistent primary pulmonary hypertension.

REFERENCES


November 2021
MANAGEMENT OF
DIABETES IN
PREGNANCY
Continuous Glucose Monitoring
Robert Egerman, M.D.

**Purpose**: Continuous glucose monitoring (CGM) is a means of measuring glucose values on a continual basis. Advantages of this methodology include avoidance of painful and uncomfortable capillary finger-sticks and frequent self-monitoring of blood glucose measurements throughout pregnancy.

**Mechanism**
To understand the mechanism of the sensor, note that in the presence of glucose oxidase, glucose is converted to gluconic acid. Peroxide is generated, and this compound reacts with a platinum electrode which creates an electric current.

The CGM device works by using a sensor within the subcutaneous or interstitium connected to a transmitter on the surface of the skin. The electrical current that is produced travels from the sensor to the transmitter. The transmitter sends radiofrequency waves to a wireless receiver (smart phone). The receiver detects the data, processes the information and calculates and displays the glucose values.

These measurements are typically performed every 5 to 15 minutes. The CGM values should be within 10 percent or less of measurements from capillary glucose values. The device needs to be changed every 7-14 days, as well as calibrated with self-glucose measurements.

![Glucose Oxidase Reaction Diagram](image)

**Indications**
- Poor glycemic control requiring frequent self-monitoring finger sticks
- Hypoglycemia unawareness
- Frequent episodes of hypoglycemia
- Nocturnal hypoglycemia
# DIABETES IN PREGNANCY: INDICATIONS FOR DELIVERY

Robert Egerman, M.D.

<table>
<thead>
<tr>
<th>Condition</th>
<th>General Timing</th>
<th>Suggested Specific Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pregestational diabetes-well controlled</td>
<td>Term</td>
<td>39 0/7 to 39 6/7 weeks</td>
</tr>
<tr>
<td>No fetal growth restriction or preeclampsia or other complication otherwise the complicating condition takes precedence over the delivery timing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pregestational diabetes- with vascular complications, poor glycemic control or prior stillbirth</td>
<td>Late preterm: 34 0/7 to 36 6/7 weeks Or Early term 37 0/7 to 38 6/7 weeks</td>
<td>36-0/7 to 38 6/7 weeks</td>
</tr>
<tr>
<td>Gestational diabetes well controlled on diet</td>
<td>Term</td>
<td>39 0/7 to 40 6/7 weeks</td>
</tr>
<tr>
<td>Gestational diabetes well controlled on medications</td>
<td>Term</td>
<td>39 0/7 to 39 6/7 weeks</td>
</tr>
<tr>
<td>Gestational diabetes poorly controlled</td>
<td>Late preterm: 34 0/7 to 36 6/7 weeks Or Early term 37 0/7 to 38 6/7 weeks</td>
<td>Individualize 36-0/7 to 38 6/7 weeks</td>
</tr>
</tbody>
</table>

References

ACOG Committee Opinion 831, July 2021,
SMFM Guidelines
November 2021
ANTEPARTUM TESTING IN PATIENTS WITH DIABETES

Margarita Berwick, M.D.

TESTING METHODS

• This department's primary surveillance method in patients with diabetes is the modified biophysical profile (BPP).
  o Non-stress test (NST)
  o Amniotic fluid volume (AFV)
    ▪ Maximum vertical pocket > 2cm
    ▪ Amniotic fluid index > 5 cm
• In the event of a non-reactive NST, all the ultrasound components of the BPP should be assessed.
  o Fetal movement
  o Fetal breathing
  o Fetal tone
  o Amniotic fluid volume
• In fetuses with growth restriction, an umbilical artery Doppler study should be performed.
## GUIDELINES FOR TESTING

<table>
<thead>
<tr>
<th>CLINICAL SCENARIO</th>
<th>INITIATION OF TESTING</th>
<th>FREQUENCY OF TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gestational diabetes, diet controlled, no comorbidities</td>
<td>40 weeks</td>
<td>Weekly</td>
</tr>
<tr>
<td>Gestational diabetes, well controlled with oral hypoglycemic agents or insulin, with or without comorbidities</td>
<td>32 weeks</td>
<td>Weekly</td>
</tr>
<tr>
<td>Gestational diabetes, poorly controlled</td>
<td>32 weeks</td>
<td>Twice weekly</td>
</tr>
<tr>
<td>Pre-gestational diabetes, well controlled, no evidence of fetal growth restriction</td>
<td>32 weeks</td>
<td>Weekly</td>
</tr>
<tr>
<td>Pre-gestational diabetes, poorly controlled, with or without comorbidities</td>
<td>28 to 32 weeks</td>
<td>Twice weekly *</td>
</tr>
</tbody>
</table>

* Umbilical artery Doppler should be performed if the fetus is growth restricted

## REFERENCES


November 2021
DIETARY RECOMMENDATIONS FOR PREGNANT PATIENTS WITH DIABETES

Patrick Duff, M.D.

- 30 – 35 kcal/kg of normal body weight
  - Rule of thumb for calculating normal body weight
    - 5 feet → 100 pounds
    - Each inch over 5 feet → 5 pounds
- Composition of diet

- Distribute calories into 3 meals and 3 snacks each day
- Recommendations for weight gain in pregnancy

<table>
<thead>
<tr>
<th>Condition</th>
<th>Pre-Pregnancy BMI</th>
<th>Weight Gain (Pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt; 18.5</td>
<td>28-40</td>
</tr>
<tr>
<td>Normal weight</td>
<td>18.5-24.9</td>
<td>25-35</td>
</tr>
<tr>
<td>Overweight</td>
<td>25.0-29.9</td>
<td>15-25</td>
</tr>
<tr>
<td>Obese</td>
<td>&gt;30</td>
<td>11-20</td>
</tr>
</tbody>
</table>
REFERENCES


December 2021
ORAL HYPOGLYCEMIC AGENTS FOR TREATMENT OF PREGNANT WOMEN WITH GESTATIONAL DIABETES

Patrick Duff, M.D.

- General goals of therapy
  - Prevent fetal macrosomia
  - Prevent neonatal hypoglycemia
  - Prevent deterioration in maternal blood glucose control, resulting in diabetic ketoacidosis
- Specific goals of therapy
  - Maintain fasting blood glucose less than 95 mg/dl
  - Maintain one-hour postprandial glucose less than 140 mg/dl
  - Maintain two-hour postprandial glucose less than 120 mg/dl
- Oral hypoglycemic agents

<table>
<thead>
<tr>
<th>Drug</th>
<th>Mechanism of Action</th>
<th>Starting Dose</th>
<th>Maximum Daily Dose In 2 Divided Doses</th>
<th>Contraindications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metformin</td>
<td>Increases insulin sensitivity Decreases intestinal absorption of glucose Decreases hepatic gluconeogenesis</td>
<td>500 mg daily</td>
<td>2000 mg</td>
<td>Renal disease</td>
</tr>
<tr>
<td>Glyburide</td>
<td>Increases insulin secretion</td>
<td>2.5 mg daily</td>
<td>20 mg</td>
<td>Sulfa allergy</td>
</tr>
</tbody>
</table>

Notes
1. As a general rule, these medications should be taken approximately 30 minutes before the morning and/or evening meal.
2. Metformin is less likely to cause hypoglycemia.
3. Glyburide is less likely to cause gastrointestinal irritation.

REFERENCE


December 2021
### Principal Types of Insulin

Danielle Elswick, CNM  
Patrick Duff, M.D.  
Adapted from *Gabbe’s Obstetrics*

<table>
<thead>
<tr>
<th>Type of Insulin</th>
<th>Onset (h)</th>
<th>Peak (h)</th>
<th>Duration (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Rapid Acting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lispro (Humalog)</td>
<td>0.25</td>
<td>0.5 - 1.5</td>
<td>4 - 5</td>
</tr>
<tr>
<td>Aspart (Novolog)</td>
<td>0.25</td>
<td>1 - 3</td>
<td>3 - 5</td>
</tr>
<tr>
<td><strong>Short Acting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humulin R</td>
<td>0.5</td>
<td>2 - 4</td>
<td>5 - 7</td>
</tr>
<tr>
<td>Novolin R</td>
<td>0.5</td>
<td>2.5 - 5</td>
<td>6 - 8</td>
</tr>
<tr>
<td>Velosulin H</td>
<td>0.5</td>
<td>1 - 3</td>
<td>8</td>
</tr>
<tr>
<td><strong>Intermediate Acting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Humulin Lente</td>
<td>1 - 3</td>
<td>6 - 12</td>
<td>18 - 24</td>
</tr>
<tr>
<td>Humulin NPH</td>
<td>1 - 2</td>
<td>6 - 12</td>
<td>18 - 24</td>
</tr>
<tr>
<td>Novolin I</td>
<td>2.5</td>
<td>7 - 15</td>
<td>22</td>
</tr>
<tr>
<td>Novolin N</td>
<td>1.5</td>
<td>4 - 20</td>
<td>24</td>
</tr>
<tr>
<td><strong>Long Acting</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Detemir (Levemir)</td>
<td>1 - 2</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Glargine (Lantus)</td>
<td>1 - 2</td>
<td></td>
<td>24</td>
</tr>
</tbody>
</table>
SPLIT DOSE INSULIN

Patrick Duff, M.D.

• Split-dose insulin refers to twice-daily doses of an intermediate insulin (Humulin Lente, Humulin NPH, Novolin I, Novolin N) and a short acting (regular) or rapid acting insulin (Lispro or Aspart).

• This regimen is relatively easy for patients to use and usually provides very good control for those individuals who do not have severe insulin dependency, particularly patients with newly-diagnosed gestational diabetes who have not responded favorably to diet and oral hypoglycemic therapy.

• The two doses should be administered approximately 30 minutes before the morning and evening meals.

• Initial calculation of total insulin dose in a patient who is not presently taking insulin:

<table>
<thead>
<tr>
<th>TRIMESTER</th>
<th>INITIAL INSULIN DOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>First</td>
<td>0.7-0.8 units/kg of actual body weight</td>
</tr>
<tr>
<td>Second</td>
<td>1.0 unit/kg of actual body weight</td>
</tr>
<tr>
<td>Third</td>
<td>1.2 units/kg of actual body weight</td>
</tr>
</tbody>
</table>

• Two-thirds of the total dose should be in the form of intermediate-acting insulin.
• One-third of the total dose should be in the form of shorter acting insulin.
• Two-thirds of the intermediate acting insulin should be given in the morning.
• One-third should be given in the evening.
• The shorter acting insulin should be evenly divided between morning and evening
• Example: A patient at 26 weeks gestation weighs 70 kg. Her total insulin dose should be 70 units – 46 units of intermediate insulin and 24 units of shorter acting insulin. 30 units of intermediate insulin should be given in the morning, and 26 units should be given in the evening. 12 units of shorter acting insulin should be given each morning and evening.
• The goals of therapy are to consistently achieve fasting sugars of less than or equal to 95 mg/dl and one-hour postprandial sugars less than or equal to 140 mg/dl.
• Guidelines for correcting abnormal values

<table>
<thead>
<tr>
<th>ABNORMAL GLUCOSE VALUE</th>
<th>INSULIN ADJUSTMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting</td>
<td>Evening intermediate insulin</td>
</tr>
<tr>
<td>1 hour after breakfast</td>
<td>Morning short acting</td>
</tr>
<tr>
<td>1 hour after lunch</td>
<td>Morning intermediate insulin</td>
</tr>
<tr>
<td>1 hour after dinner</td>
<td>Evening short acting</td>
</tr>
</tbody>
</table>

• As a general rule, try to adjust the value that is the most consistently abnormal, i.e, change one dose at a time. However, some patients may be so poorly controlled that all doses require adjustment.
• Usually one unit of insulin will decrease the serum glucose by about 15 points.

REFERENCE


January 2022
PUERPERAL ENDOMETRITIS

PATRICK DUFF, M.D.

EPIDEMIOLOGY

Endometritis occurs in less than 5% of patients having a vaginal delivery and in a significantly higher number of patients having cesarean delivery. The actual frequency depends upon the patient population, whether the cesarean was scheduled or unscheduled, and the steps taken by the physician to reduce the frequency of infection. The principal risk factors for endometritis are cesarean delivery, duration of labor, duration of ruptured membranes, number of internal vaginal examinations, and patient demographics.

MICROBIOLOGY

Endometritis is a polymicrobial, mixed aerobic-anaerobic infection. The principal pathogens are aerobic and anaerobic streptococci (Peptococci and Peptostreptococci species), anaerobic gram-negative bacilli (Bacteroides and Prevotella species), aerobic gram-negative bacilli (E. coli, Klebsiella, and Proteus species), and aerobic gram-positive cocci (enterococci, staphylococci, and group B streptococci). These organisms are part of the normal vaginal flora and are introduced into the upper genital tract and, ultimately the peritoneal cavity, during the course of labor with ruptured membranes.

CLINICAL MANIFESTATIONS

The most common clinical manifestations are fever within 24-36 hours of delivery, maternal tachycardia, tachypnea, increased uterine tenderness, and, rarely, purulent lochia.

DIFFERENTIAL DIAGNOSIS

Endometritis is almost entirely a clinical diagnosis based on the above clinical findings in the absence of any other localizing sign of infection. The peripheral white blood cell count is usually elevated, with a predominance of neutrophils. Blood cultures should be
obtained in patients who are immunosuppressed, who seem septic at the time of diagnosis, and who fail to respond promptly to therapy.

In the initial differential diagnosis of postpartum fever, endometritis is, by far, the number one consideration. Other entities include extensive atelectasis, respiratory tract infection, and pyelonephritis. Subsequently, in patients who fail to respond promptly to treatment, the following conditions must be considered: resistant microorganism, wound infection, septic pelvic vein thrombophlebitis, pelvic abscess, retained placental fragments, and drug fever.
TREATMENT

The gold standard for treatment of endometritis is the combination of intravenous clindamycin (900 mg every 8 hours) plus gentamicin (5mg/kg of ideal body weight every 24 hours) or metronidazole (500 mg every 12 hours) plus ampicillin (2 grams every 6 hours) plus gentamicin 5 mg/kg ideal body weight every 24 hours). If the patient has renal impairment, aztreonam (1 gram every 8 hours) may be substituted for gentamicin. Alternatively, one of the broad-spectrum single agents listed below can be used in place of combination therapy. These agents do not have the potential renal toxicity associated with the aminoglycosides.

Intravenous antibiotics should be continued until the patient has been afebrile for 24 hours. More than 90% of patients will respond completely within 48-72 hours. Antibiotics should then be discontinued; an extended course of oral antibiotics is not necessary.

Alternative therapies for treatment include broad-spectrum single agents such as cefepime, cefoxitin, cefotetan, ampicillin-sulbactam, piperacillin-tazobactam, imipenem-cilastatin, or meropenem. In most hospitals, these agents will be more expensive than the generic combination regimens outlined above.

<table>
<thead>
<tr>
<th>DRUG</th>
<th>INTRAVENOUS DOSE</th>
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</thead>
<tbody>
<tr>
<td>Cefepime</td>
<td>2 grams Q 8 h</td>
</tr>
<tr>
<td>Cefoxitin</td>
<td>2 grams Q 8 h</td>
</tr>
<tr>
<td>Cefotetan</td>
<td>2 grams Q 12 h</td>
</tr>
<tr>
<td>Ampicillin - sulbactam</td>
<td>3 grams Q 6 h</td>
</tr>
<tr>
<td>Piperacillin-tazobactam</td>
<td>3.375 grams Q 6 h</td>
</tr>
<tr>
<td>Imipenem-cilastatin</td>
<td>500 mg Q 6 h</td>
</tr>
<tr>
<td>Meropenem</td>
<td>1 gram Q 8 h</td>
</tr>
</tbody>
</table>
Management of the patient who fails to respond promptly to therapy is outlined below:

- Begin treatment with clindamycin plus gentamicin
- If poor response, add ampicillin to cover for enterococci
- If poor response, evaluate for wound infection and add vancomycin plus/minus incision and drainage
- If poor response, evaluate for:
  - Pelvic abscess – CT scan followed by I&D
  - Septic pelvic vein thrombophlebitis – CT scan followed by parenteral anticoagulation
  - Retained placental tissue – Ultrasound followed by surgical curettage
  - Drug fever – CBC to identify eosinophilia, then discontinue antibiotics

PREVENTION

In patients having cesarean delivery, three key interventions are of proven value in reducing the frequency of postoperative endometritis:

- Administer intravenous preoperative antibiotics – cefazolin (2 grams x 1) plus azithromycin (500 mg x 1)
- Cleanse the vagina preoperatively with a solution of povidone-iodine
- Remove the placenta by traction on the cord rather than by manual extraction

SCREENING FOR GROUP B STREPTOCOCCAL INFECTION IN PREGNANCY

Patrick Duff, M.D.

EPIDEMIOLOGY

The group B streptococcus (GBS), *Streptococcus agalactiae*, is one of the two major causes of neonatal sepsis, pneumonia, and meningitis. *E. coli* is the other dominant pathogen. Approximately 25% of pregnant women are colonized with GBS in the lower genital tract and/or rectum, and the organism is then transmitted to the fetus/neonate during the process of labor and delivery. The principal risk factors for early-onset neonatal GBS infection (infection within the first 7 days of life) are prematurity, prolonged rupture of membranes (usually defined as >18 hours), and intrapartum fever (usually due to chorioamnionitis). Treatment of colonized women with intrapartum prophylactic antibiotics has been invaluable in reducing the frequency of neonatal GBS infection to extremely low levels (0.34 – 0.37 cases per 1000 live births).

DIAGNOSIS

All patients should be screened for GBS colonization at 36-37 weeks gestation. In addition, patients with preterm labor or preterm PPROM should be screened at the time they are admitted to Labor and Delivery.

Patients who previously had an infant with GBS infection should always be considered to be colonized and do not require screening in the next pregnancy. Similarly, patients who have had GBS bacteriuria at any point in pregnancy should be considered colonized and do not require rescreening. Patients who were colonized with GBS in a previous pregnancy have approximately a 50% probability of being colonized in a subsequent pregnancy. Some clinicians simply consider them to be recolonized and do not re-screen; others will re-test in a subsequent pregnancy.

The standard of care today for identification of GBS colonization is culture. The specimen should be obtained by swabbing the lower
third of the vagina, perineum, and perianal area and then plating the swab in selective media.

Rapid NAATs for identification of GBS colonization have been developed, but they are not as sensitive as culture in identifying patients with low levels of bacterial colonization. Moreover, not all clinical laboratories are able to offer this type of sophisticated testing on a 24/7 basis.

TREATMENT

Patients who are colonized with GBS should be treated during labor with prophylactic antibiotics to reduce the frequency of maternal and neonatal infection. The preferred agent for prophylaxis is penicillin, 3 million units IV every 4 hours until delivery. An alternative first-line agent is ampicillin, 2 grams IV initially, then 1 gram every 4 hours until delivery.

If the patient has a mild allergy to penicillin, the drug of choice is cefazolin, 2 grams IV initially, then 1 gram every 8 hours until delivery. Testing for cefazolin susceptibility is not necessary because 100% of strains of GBS are sensitive to this antibiotic.

If the allergy to penicillin is severe, cefazolin should not be used. The possible alternative agents are:

- Clindamycin – 900 mg IV every 8 hours until delivery
- Vancomycin – 20 mg/kg every 8 hours until delivery
  - Maximum of 2 grams per single dose
  - Antibiotic should be infused over 1-2 hours

In our facility, 100% of strains of GBS are sensitive to vancomycin. However, only 85 to 90% of strains are sensitive to clindamycin. Therefore, in colonized patients with a severe penicillin allergy, clindamycin susceptibility testing must be performed.

REFERENCE
Background Information

Chromosome abnormalities occur in ~1/150 live births. Aneuploidy is defined as having extra or missing whole chromosomes, and microdeletions and duplications refer to loss or gain of a small portion of a chromosome and are known as copy number variants (CNVs). Trisomy 21, trisomy 18, and trisomy 13 account for the majority of cases, and risk for aneuploidy increases with maternal age. The prevalence for CNVs is 0.4%, and they occur independent of maternal age.

Current Guidelines

ACOG recommends offering screening and diagnostic testing to all patients regardless of maternal age or risk of chromosomal abnormality. Screening for aneuploidy and CNVs utilizes ultrasound, serum analytes, and cell-free DNA screening. Diagnostic options include CVS or amniocentesis.

- If screening is accepted, patients should have one approach and should not have multiple screening tests performed.
- All patients should be offered a second trimester ultrasound for fetal defects (ideally between 18-22 weeks).
- Patients with negative screening results should be counseled they have substantially decreased risk for fetal aneuploidy, but normal testing does not ensure an unaffected fetus.
- Patients with positive screening test results for fetal aneuploidy should undergo genetic counseling, comprehensive ultrasound, and opportunity for diagnostic testing.
- Patients with failed cell-free DNA screen should be informed that test failure is associated with an increased risk of fetal aneuploidy. Genetic counseling, comprehensive ultrasound, and opportunity for diagnostic testing are recommended, as opposed to simply repeating the cell-free DNA screen.
- If an increased NT or fetal anomaly is confirmed using ultrasound, the patient should be offered genetic counseling and diagnostic testing. Comprehensive ultrasound is recommended.
Protocols

Cell-free DNA Screening (LAB5463):
- Primary screening tool offered to all pregnant women.
- Viability ultrasound (OBUS – 30min) is recommended.
- NT measurement is NOT recommended.
- Anatomy ultrasound at 20 weeks is recommended (OBUS – 45min).
- Patients with a positive screening test result for fetal aneuploidy should undergo genetic counseling (REF326) and a comprehensive ultrasound evaluation (OBUS- 90min) with an opportunity for diagnostic testing to confirm results.
- Patients with an indeterminate result for fetal aneuploidy should undergo genetic counseling (REF326) and a comprehensive ultrasound evaluation (OBUS- 90min) with an opportunity for diagnostic testing to confirm results.

First Trimester Anatomy Ultrasound (OBUS- 45min):
- Indications include:
  - Maternal diabetes
  - Prior fetal abnormality
  - Abnormal first trimester ultrasound
- If abnormal, should undergo genetic counseling (REF326) and a comprehensive ultrasound evaluation (OBUS- 90min) with an opportunity for diagnostic testing to confirm results.

NT Ultrasound/ First Trimester Screening (OBUS- 45min):
- NT should be measured 11w3d to 13w6d (CRL 45-84mm), preferably >12w0d.
- If NT is normal and first trimester serum screen is normal then anatomy ultrasound at 20 weeks is recommend (OBUS- 45min).
- If NT is abnormal (>3mm), patients should undergo genetic counseling (REF326) and a comprehensive ultrasound evaluation (OBUS- 90min) with an opportunity for diagnostic testing to confirm results.
- If NT is abnormal (>3mm), patients should undergo fetal echocardiogram (REF67).
- If first trimester serum screen is abnormal, patients should undergo genetic counseling (REF326) and a comprehensive ultrasound evaluation (OBUS- 90min) with an opportunity for NIPS (LAB5463) or diagnostic testing to confirm results.

Quad Screening (LAB5308):
- Only should be offered if no aneuploidy screening was previously performed.
- If normal, then anatomy ultrasound at 20 weeks is recommend (OBUS- 45min).
- If abnormal, patients should undergo genetic counseling (REF326) and a comprehensive ultrasound evaluation (OBUS- 90min) with an opportunity for NIPS (LAB5463) or diagnostic testing to confirm results.
Chorionic Villus Sampling (OBUS- 45min):
- Should be performed at 10-14 weeks, preferably >12 weeks.
- Dr. McLean and Dr. Genc both perform transabdominal CVS
  o Transcervical CVS offered at provider discretion.
- Notify MFM fellows so one can participate.
- Outpatient: Quest Diagnostic paper test requisition must be completed and accompany specimen.
  o Specimen must be logged into specimen log book in specimen closet
- Inpatient: Cytogenetics must be ordered via miscellaneous EPIC order (LAB2002).
  o UF Path lab does not accept CVS specimens.
  o Test name, test #, and lab name must be provided. Comments are recommended but not required.
  o ARUP or Mayo test order form must be filled out and uploaded into Media tab.

Amniocentesis (OBUS- 45min):
- Should be performed at greater than or equal to 16 weeks.
- May be performed for conventional karyotype or microarray.
- All MFM faculty, except Dr. Abu-Rustum, perform amniocentesis.
- Notify MFM fellows so one can participate.
- Outpatient: Quest Diagnostic paper test requisition must be completed and accompany specimen
  o Specimen must be logged into specimen log book in specimen closet
- Inpatient: Cytogenetics must be ordered via miscellaneous EPIC order (LAB2002).
  o Test name, test #, and lab name must be provided. Comments are recommended but not required.
  o ARUP or Mayo test order form must be filled out and uploaded into Media tab
  o Alternatively, UF Path Lab will perform karyotype on amniotic fluid, but will not perform chromosomal microarray analysis on amnio specimen.

References

November 2021
Fetal Growth Restriction [FGR]
Robert Egerman, M.D.

**Frequency:** 10% pregnancies

**Definition:** A fetus that has not reached its potential in growth. Estimated fetal weight below the 10% or a fetal abdominal circumference below the 10%.

70% of fetuses below the 10% may be constitutionally small and do not have adverse perinatal outcomes. Alternatively, there are those above the 10% who still may not reach their true growth potential.

**Early FGR - diagnosis < 32 weeks in the absence of anomalies** [20-30% cases and more severe]

**Late FGR - diagnosis ≥ 32 weeks in the absence of anomalies** [70-80% of cases and less severe]

**Symmetric** - All organs are proportionally small due to early insult affecting cell hyperplasia. [20-30%]

**Asymmetric** – Relative decrease in abdomen versus head circumference. [70-80%]

*Outcomes at age 4 years may not be affected by symmetric versus asymmetric growth patterns.*

Severe FGR- Estimated weight < 3%
## Associations:

<table>
<thead>
<tr>
<th>Condition</th>
<th>Comment</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fetal genetic abnormalities</td>
<td>5-20% of fetuses with FGR Aneuploidy, uniparental disomy, single gene mutations, aberrant genomic imprinting</td>
<td>Perhaps as high as 7% with microarray-&gt; 5.4% chromosomal abnormality with FGR + an additional 10% abnormal findings with the array</td>
</tr>
<tr>
<td>Fetal infection</td>
<td>5-10% of fetuses with FGR Cytomegalovirus, Toxoplasmosis; rubella, varicella zoster, herpes simplex, syphilis, malaria</td>
<td>CMV is most likely although the percentages of fetal involvement is typically very low</td>
</tr>
<tr>
<td>Fetal structural anomaly</td>
<td></td>
<td>A detailed survey is needed</td>
</tr>
<tr>
<td>Multiple gestations</td>
<td>Can occur regardless of chorionicity</td>
<td>Sonographic assessment of growth</td>
</tr>
<tr>
<td>Confined placental mosaicism</td>
<td>10% fetuses with FGR</td>
<td>Difficult to diagnose</td>
</tr>
<tr>
<td>Ischemic placental disease</td>
<td>May be associated with stillbirth, placental abruption, preeclampsia</td>
<td>Sonographic assessment of growth</td>
</tr>
<tr>
<td>Gross placental and cord anomalies</td>
<td>Single umbilical artery, circumvallate or bilobed placenta, velamentous or marginal cord insertion</td>
<td>Evaluate the cord insertion and placenta during the sonographic evaluation</td>
</tr>
<tr>
<td>Maternal genetic factors</td>
<td>Women who were growth restricted themselves are at higher risk for having a growth restricted fetus</td>
<td>Sonographic assessment of growth</td>
</tr>
<tr>
<td>Maternal medical condition</td>
<td>Cardiac, pulmonary, hematologic, autoimmune, renal</td>
<td>Sonographic assessment of growth</td>
</tr>
<tr>
<td>Maternal obstetric condition</td>
<td>Uterine anomaly, abruption, bleeding, short pregnancy interval</td>
<td>Sonographic assessment of growth</td>
</tr>
<tr>
<td>Teratogenic and other exposures</td>
<td>Anti-epileptic drugs, opioids, tobacco, pollution</td>
<td></td>
</tr>
<tr>
<td>Assisted reproductive technology</td>
<td></td>
<td>Sonographic assessment of growth</td>
</tr>
<tr>
<td>Poor maternal nutrition or weight gain</td>
<td></td>
<td>Sonographic assessment of growth</td>
</tr>
<tr>
<td>Extremes of age</td>
<td></td>
<td>Sonographic assessment of growth</td>
</tr>
<tr>
<td>Abnormal biochemical markers</td>
<td></td>
<td>Sonographic assessment of growth</td>
</tr>
</tbody>
</table>
Complications:
Fetal demise or neonatal death
Preterm delivery
Perinatal asphyxia
Neurodevelopmental delay
Poor thermoregulation, polycythemia/hyperviscosity, impaired immune function
Adult-onset disorders of hypertension, hyperlipidemia, diabetes, coronary disease

Screening:
Fundal height: only variable sensitivity when 3 cm or > discrepancy with gestational age
Ultrasound examination

Work up:
Check the patient’s blood pressure
Assess for fetal anomalies
Offer genetic testing if early FGR [< 32 weeks] or FGR with polyhydramnios or fetal anomaly
Remember genetic counseling for a single gene disorder (not detected on array) if FGR < 1%
Infection: Cytomegalovirus, toxoplasmosis, rubella, varicella, malaria if from endemic area [SMFM recommends only CMV PCR from amniotic fluid (if an amniocentesis is performed) unless there are other findings on ultrasound]
Antiphospholipid work-up [Lupus anticoagulant, IgM and IgG for B 2 glycoprotein and anticardiolipin antibodies]
Antenatal testing, Management and Delivery [SMFM 2020]

**Normal UA:**
S/D, PI, RI ≤ 95%

**UA Decreased EDV:**
S/D, PI, RI > 95%
UA Doppler weekly
CTG 1-2x per week
Consider EFW q 2 weeks

Deliver at 37 weeks

**UA Absent EDV:**
Consider inpatient admission
UA Doppler 2-3x per week
Corticosteroids for FLM
CTG 2x per week if managed as outpatient
Consider EFW q 2 weeks

Deliver at 33-34 weeks

**UA Reversed EDV:**
Inpatient admission
Corticosteroids for FLM
CTG 1-2x per day
Consider EFW q 2 weeks

Deliver at 30-32 weeks

**EFW ≥ 3rd - 9th %ile**
UA Doppler q 1-2 weeks for 1-2 weeks if stable findings.
UA Doppler q 2-4 weeks
CTG 1x per week
EFW q 3-4 weeks

Deliver at 38-39 weeks

**EFW < 3rd %ile**
UA Doppler weekly
CTG 1x per week
Consider EFW q 2 weeks

Deliver at 37 weeks

**Post-delivery counseling**
Maternal risk for hypertensive and diabetes in future
Recurrence as high at 23%
Aspirin may help reduce risk if there are risk factors for preeclampsia
Serial sonography for growth in future pregnancies

**References**
SMFM, ACOG, UpToDate
November 2021
## Hepatitis in Pregnancy

**Patrick Duff, M.D.**

<table>
<thead>
<tr>
<th>Infection</th>
<th>Epidemiology</th>
<th>Clinical Manifestations</th>
<th>Diagnosis of Infection</th>
<th>Perinatal Complications</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Fecal-oral transmission</td>
<td>Jaundice, hepatomegaly and tenderness, acholic stools, darkened urine</td>
<td>Hepatitis A - IgM</td>
<td>Carrier state – rare Perinatal transmission – rare</td>
<td>Supportive care Hepatitis A vaccine pre- and post-exposure</td>
</tr>
<tr>
<td>B</td>
<td>Parenteral</td>
<td>Usually asymptomatic</td>
<td>Hepatitis B surface antigen Hepatitis B e antigen in some patients</td>
<td>Perinatal transmission Rate is very high when mother also is positive for hepatitis B e antigen Chronic liver disease</td>
<td>HBIG within 12 hours of birth Begin HBV series prior to hospital discharge For mothers with a viral load &gt; 1 million copies/ml, treat with tenofovir, 300 mg daily from 28 weeks until delivery</td>
</tr>
<tr>
<td></td>
<td>Sexual contact</td>
<td></td>
<td>PCR – viral load</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Perinatal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Parenteral</td>
<td>Usually asymptomatic</td>
<td>Hepatitis C antibody PCR – viral load</td>
<td>Perinatal transmission is significantly increased in presence of HIV infection and high viral load Chronic liver disease</td>
<td>Cesarean delivery for patient infected with both HBC and HIV Strongly consider cesarean delivery if viral load is &gt; 2 million</td>
</tr>
<tr>
<td></td>
<td>Sexual contact</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Perinatal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Parental</td>
<td>Usually asymptomatic</td>
<td>Hepatitis D antigen Hepatitis D antibody</td>
<td>Perinatal transmission</td>
<td>Immunoprophylaxis for hepatitis B is fully protective</td>
</tr>
<tr>
<td></td>
<td>Sexual contact</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Perinatal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Fecal-oral transmission</td>
<td>Same as for hepatitis A</td>
<td>Hepatitis E antibody</td>
<td>Carrier state – rare Perinatal transmission – rare</td>
<td>Supportive care Hepatitis E vaccine</td>
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November 2021
HERPES SIMPLEX VIRUS INFECTION IN PREGNANCY

Patrick Duff, M.D.

EPIDEMIOLOGY

Herpes simplex is a DNA-virus that has two major strains – HSV-1 and HSV-2. The former organism usually causes oral lesions, the latter genital lesions. However, both viruses can cause oral and genital lesions, depending upon the patient’s sexual practices. Genital infection is the condition that poses a significant risk to the neonate. Approximately 16% of women in the age range 14 to 49 years have evidence of antibody to HSV-2.

CLINICAL MANIFESTATIONS

Genital herpes may present as three syndromes:

- **First-episode primary genital herpes**
  - Patient has no antibodies to either HSV-1 or HSV-2
  - Prodromal symptoms include paresthesias and pain on the external genitalia or within the vagina
  - Multiple genital lesions that progress from papules to vesicles to pustules to ulcers to crusted lesions and evolve over 3 to 6 weeks
  - Regional adenopathy
  - Constitutional signs and symptoms such as headache, fever, chills, malaise
  - Dysuria
  - Urinary retention

- **First-episode non-primary genital herpes**
  - May be caused by HSV-1 or HSV-2
  - Patient has antibodies to the opposite serotype
  - Fewer lesions and constitutional symptoms

- **Recurrent genital herpes infection**
  - Patient has antibody to the serotype causing the infection
  - Fewer lesions - duration of lesions is 3 to 10 days
  - Very few, if any, constitutional symptoms
DIAGNOSIS

- Physical examination
- Viral culture
- PCR
- Culture and PCR are more likely to be positive when the specimen is obtained from a fresh vesicle

RISK TO THE FETUS AND NEONATE

- Transplacental infection is rare
- Infection occurs primarily as the fetus encounters virus in the maternal genital tract during labor and delivery
- If the mother has a primary herpes infection at the time of labor (high viral inoculum and no pre-existing antibody), approximately 40 to 50% of neonates will be infected if delivered vaginally. A sizeable minority of these infants will die and most of the survivors will have severe neurologic morbidity despite antiviral therapy.
- If vaginal delivery occurs in the setting of a recurrent infection (lower viral inoculum, positive maternal antibody), no more than 5% of the neonates will be infected.
- If the mother is asymptptomatically shedding HSV at the time of vaginal delivery, fewer than 1% of neonates will be infected.

MANAGEMENT

- An acute HSV episode (either primary or recurrent) during pregnancy should be treated with one of these regimens:
  - Acyclovir, 400 mg orally three times daily for 7 to 10 days, depending upon the speed with which the lesions resolve.
  - An alternative, but more expensive regimen, is valacyclovir, 1000 mg orally twice daily for 7 to 10 days.
  - If the patient cannot tolerate either of these agents, an alternative is famciclovir, 250 mg orally three times daily for 7 to 10 days
• A patient with multiple frequent recurrences should be treated throughout pregnancy with suppressive doses of either oral acyclovir or valacyclovir.
  o Acyclovir, 400 mg three times daily
  o Valacyclovir, 500 mg twice daily
• Any patient with a history of recurrent HSV infection, even in the absence of frequent recurrences, should receive suppressive doses of either oral acyclovir or valacyclovir from 36 weeks until delivery, in the doses outlined above.
• Any patient with prodromal symptoms or overt genital lesions at the time of labor, with or without ruptured membranes, should be delivered by cesarean.
• A patient with preterm PROM who has an acute HSV infection at the time of presentation should be treated with therapeutic doses of antiviral agents until the lesions resolve and then managed per the usual PPROM protocol.

REFERENCE


November 2021
HUMAN IMMUNODEFICIENCY VIRUS INFECTION

EPIDEMIOLOGY

Human immunodeficiency virus infection is caused by a single-stranded, enveloped RNA retrovirus. Two major strains of the virus have been identified: HIV-1 and HIV-2; each has several sub-strains. HIV-1 infection is more widely prevalent throughout the world and certainly in the United States.

The most common mechanism of transmission is sexual contact. The principal risk factors for sexual transmission of HIV infection are multiple partners, unprotected coitus, coitus during menses, coitus in the presence of ulcerated genital tract lesions (specifically, syphilis, herpes, and chancroid), and traumatic sexual contact, e.g., from sexual assault. Intravenous drug use and perinatal transmission are also important mechanisms of transmission of HIV infection.

CLINICAL MANIFESTATIONS

The initial stage of infection is termed the acute retroviral illness, and the clinical presentation is similar to severe influenza. Patients then enter the latent phase of illness, which, with proper treatment, may extend for several decades. The late symptomatic stage of infection is characterized by malignancies, such as Kaposi’s sarcoma and non-Hodgkin’s lymphoma, and a variety of opportunistic infections caused by pathogens such as:

- Candida albicans
- Cryptococcus neoformans
- Cytomegalovirus
- Herpes simplex
- Mycobacterium avium intracellulare
- Mycobacterium tuberculosis
- Pneumocystis jiroveci
- Toxoplasma gondii
DIAGNOSIS

• All pregnant women should be screened for HIV infection at the time of the first prenatal appointment. The opt-out strategy is superior to the opt-in strategy in identifying infected patients.
• Screening should be repeated at the beginning of the third trimester if the patient has continued risk factors for infection.
• The initial screening test is the HIV-1/2 Antigen and Antibody, Fourth Generation EIA.
• If this test is positive, the laboratory should perform the HIV-1/HIV-2 Antibody Differentiation Immunoassay (Multispot Test). If this test is positive, it confirms the diagnosis and distinguishes between HIV-1 and HIV-2.
• If the Antibody Differentiation Immunoassay is negative or indeterminate, the laboratory should then reflexly test for HIV RNA by PCR. If this test is positive, the diagnosis is confirmed. If it is negative, the patient should be re-tested in 3-4 months to determine if seroconversion has occurred.

ADDITIONAL LABORATORY STUDIES IN SEROPOSITIVE PATIENTS

• CD4 count
• CD4/CD8 ratio
• CMV serology
• Complete blood count with differential
• Comprehensive metabolic panel
• Hepatitis B surface antigen
• Hepatitis C antibody
• Quantiferon Gold Test for TB (followed by chest x-ray if positive)
• Toxoplasmosis serology
• Treponema pallidum antibody
• Viral load (repeat in third trimester to determine mode of delivery)
MANAGEMENT

Antiretroviral Therapy
  • All patients should be treated with highly active anti-retroviral therapy (HAART) once the diagnosis is established. Types of medication include:
    o Nucleotide reverse transcriptase inhibitors
    o Nucleoside reverse transcriptase inhibitors
    o Fusion inhibitors
    o Integrase inhibitors
    o Protease inhibitors
  • Therapy should consist of 3 to 4-drug regimens, based upon the patient’s prior response to treatment, if applicable, and/or the resistance pattern of the HIV organism. A member of the Division of Infectious Diseases/Department of Medicine is available in the Monday morning HROB clinic to assist in planning therapy for these patients.

Vaccinations to Prevent Opportunistic Infections
  • COVID-19
  • Hepatitis B
  • Influenza
  • Pneumococcal
    o 13 serovalent
    o 23 serovalent
# Prophylactic Antibiotics to Prevent Opportunistic Infections

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Indications for Prophylaxis</th>
<th>Antibiotic Regimen</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Candida albicans</em></td>
<td>Recurrent severe oropharyngeal and/or vulvovaginal infection</td>
<td>Fluconazole, 150 mg orally each day</td>
</tr>
<tr>
<td><em>Cryptococcal neoformans</em></td>
<td>Maintenance after treatment of acute infection</td>
<td>Fluconazole, 200 mg orally each day</td>
</tr>
<tr>
<td><em>Herpes simplex</em></td>
<td>Multiple frequent recurrences or prevention of recurrent infection near term</td>
<td>Acyclovir, 400 mg orally twice daily (x 3 per day in late pregnancy) OR Valacyclovir, 1000 mg orally each day</td>
</tr>
<tr>
<td><em>Mycobacterium avium intracellularae</em></td>
<td>CD4 count &lt;50 cells/mm3</td>
<td>Azithromycin, 1200 orally each week OR Clarithromycin, 500 mg orally twice daily</td>
</tr>
<tr>
<td><em>Pneumocystis jiroveci</em></td>
<td>CD4 count &lt; 200 cells/mm3</td>
<td>Trimethoprim-sulfamethoxazole DS daily or 3 x week</td>
</tr>
<tr>
<td>TB</td>
<td>Positive Quantiferon Gold, negative chest x-ray</td>
<td>INH, 300 mg orally each day combined with vitamin B6, 50 mg orally each day x 9 months</td>
</tr>
<tr>
<td><em>Toxoplasma gondii</em></td>
<td>CD4 count &lt; 100 cells/mm3</td>
<td>Trimethoprim-sulfamethoxazole DS orally each day or 3 x weekly</td>
</tr>
</tbody>
</table>
Delivery

- If the patient’s viral load is less than 1000 copies/ml (ideally less than 50 copies/ml), she is a candidate for vaginal delivery.
  - Allow spontaneous labor unless the pregnancy extends to 41 weeks
  - Avoid induction of labor when the cervix is very unfavorable
  - Avoid rupture of membranes if possible
  - Avoid application of a scalp electrode unless absolutely necessary
  - Avoid instrumental delivery if possible
  - Avoid episiotomy unless absolutely necessary
  - Minimize risk of vaginal/perineal laceration
  - Administer prophylactic intravenous zidovudine during labor
    - 2 mg/kg loading dose over one hour
    - 1 mg/kg each hour until delivery
- If the patient’s viral load is > 1000 copies/ml, she should be scheduled for a cesarean delivery at 38 weeks gestation
  - Administer prophylactic intravenous zidovudine (as above) for 3 hours prior to surgery

REFERENCES


November 2021
NAUSEA AND VOMITING IN PREGNANCY

Viktoriya Kashin, DNP, APRN

EPIDEMIOLOGY

Virtually all pregnant women experience nausea, and even vomiting, during the first trimester. The problem usually resolves as pregnancy advances into the second trimester. The nausea is due primarily to the effects of increasing serum HCG concentrations on the chemoreceptor trigger zone in the brain and, secondarily, to the gastroparesis that occurs during pregnancy.

Only a minority of patients (0.5 – 2.0%) develop true hyperemesis gravidarum, defined by a weight loss of greater than 5% of the pregravid weight, electrolyte abnormalities (hypokalemic, hypochloremic, metabolic alkalosis), and ketonuria. Hyperemesis is particularly likely to occur in the presence of a multiple gestation or molar pregnancy.

DIAGNOSIS

- Patients with protracted nausea and vomiting will usually present with tachycardia, decreased blood pressure, and signs of dehydration such as increased skin turgor, and depressed sensorium.
- The differential diagnosis of hyperemesis includes:
  - Bacterial or viral gastroenteritis
  - Cannabinoid hyperemesis syndrome
  - Cholelithiasis and cholecystitis
  - Hepatitis
  - Hyperthyroidism
  - Pancreatitis
  - Pyelonephritis
- The following laboratory studies are indicated
<table>
<thead>
<tr>
<th>TEST</th>
<th>PURPOSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amylase and lipase</td>
<td>Screen for pancreatitis</td>
</tr>
<tr>
<td>Complete blood count</td>
<td>Screen for indirect evidence of bacterial or viral infection</td>
</tr>
<tr>
<td>Electrolytes</td>
<td>Check for metabolic derangements such as hypokalemia, hyponatremia,</td>
</tr>
<tr>
<td></td>
<td>hypochloremia, and metabolic alkalosis</td>
</tr>
<tr>
<td>Liver function tests</td>
<td>Screen for viral hepatitis</td>
</tr>
<tr>
<td>Thyroid function tests</td>
<td>Screen for hyperthyroidism</td>
</tr>
<tr>
<td>Urinalysis and culture</td>
<td>Screen for pyelonephritis</td>
</tr>
<tr>
<td>Ultrasound of upper abdomen</td>
<td>Screen for cholelithiasis</td>
</tr>
<tr>
<td>Ultrasound of uterus</td>
<td>Screen for multiple gestation or mole</td>
</tr>
</tbody>
</table>

**MANAGEMENT**

- **Mild symptoms**
  - Small frequent meals and snacks
  - BRAT diet – bananas, rice, applesauce, toast
  - Avoidance of triggers such as strong odors
  - Avoidance of supine position immediately after meals
  - Avoidance of THC – rather than relieving nausea, marijuana may actually accentuate the symptom
  - Ginger – 1–1.5 grams in divided doses over 24 hours
  - Acupuncture or acupressure (sea sickness bracelets)

- **Progressively more severe symptoms**
  - All of the above plus one or more of the following oral medications
    - Vitamin B6 (pyridoxine, 25 mg) plus doxylamine succinate (Unisom) – every 6 hours
    - Diphenhydramine (Benadryl) – 25 mg every 6 hours
    - Dimenhydrinate (Dramamine) – 25 mg every 6 hours
    - Doxylamine (10 mg) plus pyridoxine (10 mg) (Diclegis) – two tablets at bedtime. May add one tablet in the morning and one tablet at midday if symptoms are not controlled with the single bedtime dose
    - Meclizine (Antivert) – 25 mg every 6 hours
    - Metoclopramide (Reglan) – 5–10 mg 30 minutes before meals and at bedtime
    - Promethazine (Phenergan) – 25 mg every 6 hours
    - Prochlorperazine (Compazine) – 5 – 10 mg every 6 hours
    - Chlorpromazine (Thorazine) – 25 mg every 6 hours
    - Ondansetron (Zofran) – 4 mg every 8 hours
• The oral disintegrating tablets may be better tolerated and may work more effectively, especially when gastroparesis is contributing to the patient's symptoms
• Try to avoid this medication until at least 10 weeks gestation
  ▪ Omeprazole – 20 mg each morning

  • Severe symptoms with evidence of hypovolemia and weight loss
    o Intravenous fluids
      ▪ Ringer’s lactate and Plasmalyte are preferred over normal saline because the latter solution is more likely to cause renal injury.
      ▪ Supplemental potassium (e.g. 10-20 meq/liter) should be added to the hydrating solution if hypokalemia is present
    o Administer the anti-emetic medications listed above intravenously or per rectal suppository
    o Administer glucocorticoids
      ▪ Methylprednisolone – 16 mg intravenously every 8 hours x 48-72 hours
      ▪ Hydrocortisone – 100 mg intravenously every 12 hours x 48-72 hours
      ▪ Oral prednisone, 40 mg on day 1, 20 mg for 3 days, 10 mg for 3 days, then 5 mg for 7 days
      ▪ Dexamethasone – 4 mg daily x 14 days, then 2 mg daily x 7-14 days
    o Aprepitant (Emend)
      ▪ Reserve for the most refractory cases
      ▪ 80 mg orally each day, as needed
      ▪ Medication is extremely expensive

REFERENCE


December 2021
Chronic Hypertension in Pregnancy

Robert Egerman, M.D.

**Frequency:** 1-2% of pregnancies

**Definition:**

Non-pregnant reference per American College of Cardiology and the American Heart Association

<table>
<thead>
<tr>
<th>Category</th>
<th>Systolic</th>
<th>Diastolic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>&lt; 120 mm Hg</td>
<td>&lt; 80 mm Hg</td>
</tr>
<tr>
<td>Elevated</td>
<td>120-129 mm Hg</td>
<td>&lt; 80 mm Hg</td>
</tr>
<tr>
<td>Stage 1 Hypertension</td>
<td>130-139 mm Hg</td>
<td>80-89 mm Hg</td>
</tr>
<tr>
<td>Stage 2 Hypertension</td>
<td>≥ 140 mm Hg</td>
<td>≥ 90 mm Hg</td>
</tr>
</tbody>
</table>

Pregnancy categories per ACOG

<table>
<thead>
<tr>
<th>Category</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>Systolic ≥ 140 or diastolic ≥ 90 mm Hg measured on 2 occasions 4 hours apart</td>
</tr>
<tr>
<td>Severe Range Hypertension</td>
<td>Systolic ≥ 160 or diastolic ≥ 110 mm Hg measured on 2 occasions 4 hours apart</td>
</tr>
<tr>
<td>Chronic Hypertension</td>
<td>Hypertension diagnosed before pregnancy or before 20 weeks gestation or hypertension first diagnosed during pregnancy that does not resolve postpartum</td>
</tr>
<tr>
<td>Chronic Hypertension with Superimposed Preeclampsia</td>
<td>Preeclampsia in a patient with hypertension before pregnancy or before 20 weeks gestation</td>
</tr>
</tbody>
</table>

**Blood pressure measurement:**

Patient should be seated with feet on the floor or in bed with head of bed elevated 30 degrees

Cuff length should be 1.5 x of arm circumference
Cuff width should be 40% or greater of arm circumference
Cuff bladder should encircle 80% of arm circumference
Home blood pressure monitoring:
Wrist cuff may not be accurate
Confirm accuracy with clinic sphygmomanometer
Check Consumer Reports® for updated optimal product selection [Omron, etc]

**Risks:**

**Maternal**
Cerebrovascular accident [x 5 fold increase]
Renal failure [x 5]
Pulmonary edema [x 5]
Indicated preterm birth
Superimposed preeclampsia
Gestational diabetes [x 1.6]
Placental abruption
Cesarean delivery
Long-term risk for cardiovascular disease

**Fetal**
Fetal growth restriction
Low birth weight [20%]
Preterm delivery [30%, indicated]
Anomalies [x 1.4]
Stillbirth [x 4]
Evaluation of patient:

History
   Antecedent hypertension
   Other medical conditions
   Antecedent preeclampsia
   Medication or drug or ethanol use

Physical examination
   Blood pressure in both arms ideally
   Pulse
   Is there proptosis or a goiter or an intrascapular hump or abdominal striae?
   Are the lungs clear?
   Are there murmurs or gallops on cardiac auscultation?
   Are there flank bruits?
   Are the dorsalis pedis and radial pulses concordant?

Laboratory assessment
   Comprehensive metabolic panel
   TSH
   CBC with differential
   A1c if indicated
   Urine protein to creatinine ratio [< 0.15 means < 300 mg of protein in 24 hours]
   12-lead ECG or echocardiogram as appropriate
Assess for secondary causes

<table>
<thead>
<tr>
<th>Findings</th>
<th>Concern</th>
<th>Investigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labile blood pressure</td>
<td>Pheochromocytoma</td>
<td>24 hour urine metanephrines and catecholamines</td>
</tr>
<tr>
<td>Palpitations, pallor, dizziness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snoring</td>
<td>Sleep apnea</td>
<td>Sleep study</td>
</tr>
<tr>
<td>Muscle cramps (from hypokalemia)</td>
<td>Primary hyperaldosteronism</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Secondary hyperaldosteronism</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>*Most cases of hypokalemia during pregnancy are due to vomiting or to physiologic changes. Aldosterone to renin ratio Renal ultrasound and doppler Late night salivary cortisol 3 times upper limit of normal or urinary free cortisol 4 times upper limit of normal</td>
</tr>
<tr>
<td>Weight loss, palpitations, heat intolerance, anxiety</td>
<td>Hyperthyroidism</td>
<td>TSH, Free T4</td>
</tr>
<tr>
<td>Edema, fatigue, urinary frequency</td>
<td>Kidney disease</td>
<td>Urinalysis, serum creatinine</td>
</tr>
<tr>
<td>Discordant distal pulses or history of aortopathy</td>
<td>Coarctation</td>
<td>Echocardiogram or CTA or MRI</td>
</tr>
</tbody>
</table>

Treatment: [Below pertains to treating chronic hypertension, NOT preeclampsia or superimposed preeclampsia]

When to start treatment? This is somewhat controversial.

Always ask the question, Is this preeclampsia?

Magee et al, N Engl J Med 2015, randomized roughly 500 patients to tight [diastolic target 85 mm Hg] versus less tight [diastolic target 100 mm Hg]. Most patients were on labetalol. There were no differences in primary outcome of pregnancy loss, NICU care, SGA or neonatal respiratory complications. Regarding secondary outcomes, there were higher risks for severe maternal hypertension, thrombocytopenia and transamninitis in the less tight control group.

Begin therapy when blood pressure reaches 150 mm Hg systolic or 95 mm Hg diastolic.

For those with end organ damage [cardiac disease, renal disease, vascular or eye disease] or advancing maternal age, a lower threshold can be considered.

Goal should be blood pressure around 140 mm Hg systolic and 90 mm Hg diastolic.

Again, a lower threshold (130 mm Hg systolic or 80 mm Hg diastolic) can be considered for those with end organ damage.
Be careful in the setting of fetal growth restriction to not lower maternal blood pressure too much.

May need inpatient assessment when systolic $\geq 150$ mm Hg or diastolic $\geq 100$ mm Hg.

Begin low dose aspirin (81 to 162 mg/day) at 12 weeks gestation.

Nifedipine and labetalol are the preferred antihypertensive agents.

## Medications

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dosage</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>abetralol</td>
<td>200–2,400 mg/d orally in two to three divided doses. Commonly initiated at 100–200 mg twice daily</td>
<td>Potential bronchoconstrictive effects. Avoid in women with asthma, preexisting myocardial disease, decompensated cardiac function, and heart block and bradycardia. Do not use sublingual form. Immediate-release formulation should generally be reserved for control of severe acutely elevated blood pressures in hospitalized patients. Should be avoided in tachycardia.</td>
</tr>
<tr>
<td>lifedipine</td>
<td>30–120 mg/d orally of an extended-release preparation. Commonly initiated at 30–60 mg once daily (extended-release)</td>
<td></td>
</tr>
</tbody>
</table>

## Antenatal testing

<table>
<thead>
<tr>
<th>Condition</th>
<th>Gestational age to begin testing</th>
<th>Frequency of fetal testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic hypertension</td>
<td>32 weeks gestation</td>
<td>Weekly</td>
</tr>
<tr>
<td>Controlled with medications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poorly controlled or associated with medical disorders</td>
<td><em>At the time of diagnosis or the gestational age when delivery would be considered for abnormal results</em></td>
<td>Twice weekly or individualized</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Delivery timing

<table>
<thead>
<tr>
<th>Condition</th>
<th>General Timing</th>
<th>Suggested Specific Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic hypertension: isolated, controlled, uncomplicated, no medication</td>
<td>Early term [37 0/7 to 38 6/7 weeks] or Term</td>
<td>38 0/7 to 39 6/7 weeks</td>
</tr>
<tr>
<td>Chronic hypertension: isolated, uncomplicated, controlled on medication</td>
<td>Early term [37 0/7 to 38 6/7 weeks] or Term</td>
<td>37 0/7 to 39 6/7 weeks</td>
</tr>
<tr>
<td>Chronic hypertension: difficult to control need medication adjustments</td>
<td>Late preterm [34 0/7 to 36 6/7 weeks] Early term [37 0/7 to 38 6/7 weeks]</td>
<td>36 0/7 to 37 6/7 weeks</td>
</tr>
</tbody>
</table>

## Postpartum

Blood pressure goal is systolic < 150 mm Hg or diastolic < 90 mm Hg, although these measurements are maximums and typically should be lower.

Follow up blood pressure check in clinic within the week of hospital discharge.

Avoid estrogen containing contraceptive in the setting of uncontrolled hypertension.

Give precautions of swelling, fatigue, headache, abdominal pain or shortness of breath requires a return for evaluation.

## References

ACOG, UpToDate

November 2021
INDUCTION OF LABOR

Patrick Duff, M.D.

INDICATIONS FOR INDUCTION OF LABOR

Fetal indications include, but are not limited to, the following:
- Fetal death in utero
- Non-reassuring fetal status, based on antenatal testing with ultrasound (amniotic fluid volume, umbilical artery Doppler velocimetry) and fetal heart rate monitoring
- Severe fetal growth restriction
- Fetal anomaly that requires urgent correction ex utero – e.g., progressive urinary tract obstruction or gastroschisis with evidence of fetal bowel obstruction and/or perforation

Maternal indications include, but are not limited to, the following:
- Worsening control of diabetes
- Worsening control of hypertensive disorder
- Worsening control of severe cardiopulmonary disease
- Worsening control of severe renal disease
- Preterm premature rupture of membranes
- Premature rupture of membranes at term

THE MODIFIED BISHOP SCORE

- The choice of method of induction is dependent upon whether the cervix is favorable or unfavorable for induction of labor.
- The assessment of a “favorable cervix” is based on the modified Bishop Score

<table>
<thead>
<tr>
<th>Variable</th>
<th>0 Points</th>
<th>1 Point</th>
<th>2 Points</th>
<th>3 Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistency</td>
<td>Firm</td>
<td>Moderate</td>
<td>Soft</td>
<td></td>
</tr>
<tr>
<td>Position in sagittal plane of vagina</td>
<td>Posterior</td>
<td>Mid-position</td>
<td>Anterior</td>
<td></td>
</tr>
<tr>
<td>Effacement</td>
<td>0-30%</td>
<td>40-50%</td>
<td>50-79%</td>
<td>Greater than or equal to 80%</td>
</tr>
<tr>
<td>Dilation</td>
<td>Closed</td>
<td>1-2 cm</td>
<td>3-4 cm</td>
<td>&gt; 4 cm</td>
</tr>
<tr>
<td>Station</td>
<td>-3 cm</td>
<td>-2 cm</td>
<td>-1 cm to 0</td>
<td>+1 to +2 cm</td>
</tr>
</tbody>
</table>
• A Bishop score less than 4 is considered very unfavorable
• A Bishop score of 4 to 5 is considered moderately favorable
• A Bishop score of 6 or greater is considered very favorable
• Having a “favorable Bishop score” does not ensure that the patient will deliver vaginally. However, it does indicate that the induction should be successful in getting the patient into the active phase of labor.

**SELECTION OF METHOD OF INDUCTION**

<table>
<thead>
<tr>
<th>BISHOP SCORE</th>
<th>PREFERRED METHOD OF INDUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 or greater</td>
<td>Amniotomy combined with oxytocin infusion</td>
</tr>
<tr>
<td>4 to 5</td>
<td>Insertion of foley bulb (inflate to 30 ml) combined with oxytocin infusion and early amniotomy</td>
</tr>
<tr>
<td>Less than 4</td>
<td>Vaginal misoprostol, (25 micrograms every 3-6 hours) followed by oxytocin infusion when the cervix is more favorable. Oxytocin may be started 4 hours after the last dose of misoprostol. OR insertion of foley bulb combined with oxytocin infusion</td>
</tr>
</tbody>
</table>

**OXYTOCIN INFUSION REGIMENS**

<table>
<thead>
<tr>
<th>REGIMEN</th>
<th>STARTING DOSE (mU/min)</th>
<th>INCREMENTAL INCREASE (mU/min)</th>
<th>DOSAGE INTERVAL (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Dose</td>
<td>0.5-2</td>
<td>1-2</td>
<td>15-40</td>
</tr>
<tr>
<td>High Dose</td>
<td>6</td>
<td>3-6</td>
<td>15-40</td>
</tr>
</tbody>
</table>
KEY GUIDELINES DURING INDUCTION

- Be certain that fetus is in a cephalic presentation.
- Be certain there is no contraindication to vaginal delivery such as a fetal macrosomia or history of a prior vertical uterine scar or a deep myomectomy.
- Employ continuous fetal monitoring. Insertion of the intrauterine pressure catheter is desirable once amniotomy can be easily accomplished.
- Do not perform amniotomy until the fetal head is well applied to the cervix and insertion of the amniohook is easy to accomplish.
- Be aware that, with an unfavorable cervix, the latent phase of labor may extend up to 19 hours in a primigravida and up to 14 hours in a multigravida before it is considered “prolonged.” Therefore, be wary about diagnosing a “failed induction” too soon in the labor process. In the latent phase of labor, wait at least 24 hours after the start of the oxytocin infusion and after AROM before diagnosing a failed induction. Of course, individualization of care is always appropriate.
- Do not use misoprostol for induction if a patient has had a prior cesarean delivery. Misoprostol increases the probability of uterine scar dehiscence.
- Be wary of attempting induction with oxytocin in a patient who has had a prior low transverse cesarean and who has an unfavorable cervix.
- Do not routinely perform induction in an otherwise uncomplicated patient who is 39 weeks but who has an unfavorable cervix.

REFERENCE


January 2022
PREVENTION AND TREATMENT OF VIRAL INFLUENZA IN PREGNANCY

Patrick Duff, M.D.

EPIDEMIOLOGY

Viral influenza is caused by influenza A and B viruses. Although pregnant women are not more likely to contract influenza than non-pregnant women, they are more likely to become seriously ill if they become infected. In every influenza pandemic, pregnant women have suffered disproportionately high morbidity and mortality.

Infection is spread by respiratory droplets. The R factor ranges from 1 to 2.

CLINICAL MANIFESTATIONS AND DIAGNOSIS

The usual clinical manifestations of influenza include high fever (in the range of 39 degrees Centigrade), shaking chills, severe myalgias and arthralgias, rhinorrhea, and cough. The diagnosis usually can be established by physical examination alone, although detection of viral antigen in nasopharyngeal secretions may be helpful in confirming the clinical impression.

PREVENTION

The most effective ways to prevent viral influenza are to:

- Avoid direct contact with other individuals who may be infected.
- Wear a facemask in anticipation of contact with potentially infected persons.
- Wash hands carefully and frequently throughout the day, especially after exposure to potentially contaminated environmental surfaces.
- **Receive the annual influenza vaccine.**
  - Pregnant women should receive only the inactivated intramuscular quadrivalent vaccine, not the live intranasal vaccine.
  - The optimal time for immunization is late summer through the spring.
  - Although most influenza vaccines contain trace amounts of egg protein, multiple studies have shown that patients with a documented egg allergy are not at increased risk for an adverse reaction to any influenza vaccine.
  - Patients with such an allergy who are still reluctant to accept the vaccine may receive Flublok Quadrivalent, a recombinant vaccine that is produced without the use of either the influenza virus or chicken eggs.
If a patient is exposed to an infected contact before receiving her influenza vaccination, she should be given one of two forms of prophylaxis and then vaccinated.
  - Oseltamivir, 75 mg orally daily for 7 days after exposure
  - Zanamivir, 2 puffs by inhalation every 24 hours for 7 days after exposure

**TREATMENT**

Supportive treatment should be started immediately once the diagnosis is suspected/confirmed:
  - Acetaminophen for control of pain and fever – maximum of 3 grams in 24 hours
  - Rest at home until symptoms are improved and control of respiratory secretions is secure
  - Oral fluids

Antiviral therapy also should be started within 48 hours of the onset of illness:
  - Oseltamivir, 75 mg orally twice daily for 5 days
  - Zanamivir, 2 puffs by inhalation, every 12 hours for 5 days

If superimposed bacterial infection is suspected, the patient should be treated with antibiotics such as ceftriaxone, azithromycin, and levofloxacin.


October 2021
INTRAHEPATIC CHOLESTASIS OF PREGNANCY

Joy Cosenza, APRN, CNM

EPIDEMIOLOGY

Intrahepatic cholestasis of pregnancy (ICP) usually occurs in the second and third trimesters of pregnancy and is characterized by pruritis and elevated serum bile acid levels. The incidence of ICP ranges from 0.3%-15% in various populations, with most of the estimates ranging from 0.3%-0.5%. The cause of ICP is complex, with genetic, endocrine, and environmental factors playing roles. Risk factors for ICP include hepatitis C, nonalcoholic liver cirrhosis, multiple gestation, gallstones, cholecystitis, nonalcoholic pancreatitis, advanced maternal age, a history of ICP in a previous pregnancy, and a family history of ICP.

CLINICAL MANIFESTATIONS

The characteristic manifestation of ICP is intense pruritus. The pruritus may be generalized or may be confined primarily to the palms of the hands and soles of the feet.

DIAGNOSIS

- Characteristic clinical findings
- Elevated serum concentration of total bile acids > 10 micromoles per liter
- Serum concentrations of hepatic transaminases may or may not be elevated

FETAL COMPLICATIONS

ICP is associated with several adverse perinatal outcomes, including stillbirth, meconium-stained amniotic fluid, and preterm birth (both spontaneous and iatrogenic). The incidence of stillbirth after 37 weeks of gestation attributable to ICP is estimated to be at 1.2%. The highest risk for stillbirth occurs in women with total bile acid levels ≥100 μmol/L. Although the risk of stillbirth may be lower at lower bile acid levels, some degree of risk may still be present even with bile acids < 40 μmol/L.

TREATMENT

Pharmacologic treatment of ICP has 2 potential goals: to reduce the maternal symptoms of pruritus and to reduce the risk for adverse perinatal outcomes.

- Ursodeoxycholic acid (UDCA) is the first line agent for the treatment of ICP. UDCA is effective in relieving pruritus and improving laboratory abnormalities and has no known adverse effects on the fetus.
  - Starting dose for UDCA is 10-15 mg/kg per day divided into 2 or 3 doses.
  - Typical regimens are 300 mg BID or TID or 500 mg BID.
  - A decrease in pruritis is usually seen within 1-2 weeks.
  - If pruritis is not relieved, the dose can be titrated to a maximum of 21 mg/kg per day.
  - Biochemical improvement is usually seen within 3-4 weeks.
• Alternatively, cholestyramine (4 grams orally twice daily; may increase to 8 mg twice daily) can be administered to patients who cannot take UDCA or who have continued symptoms on the maximum dosage of UDCA
• Antihistamines such as diphenhydramine (25 mg orally every 6 to 8 hours) or hydroxyzine (25 mg orally every 6 to 8 hours) can be used for pruritus, although these may have limited benefit, and they are very sedating.
• Topical antipruritics such as menthol creams and calamine lotion of limited benefit.

MONITORING AND TIMING OF DELIVERY

• Repeat bile acid measurement in the mid-third trimester may be useful in guiding delivery timing, especially in severe cases, but weekly serial testing is not recommended.
• Begin antenatal fetal surveillance at a gestational age when delivery would be performed in response to abnormal fetal testing results, or at the time of diagnosis if the diagnosis is made later in gestation.
• If total bile acid levels are ≥100 μmol/L, offer delivery at 36 0/7 weeks of gestation, given that the risk of stillbirth increases substantially around this gestational age.
• Delivery is recommended between 36 0/7 and 39 0/7 weeks of gestation for patients with ICP and total bile acid levels of <100 μmol/L.
  o It is reasonable for patients with bile acid levels <40 μmol/L to delivered toward the later end of this time range
  o Women with total bile acid levels of ≥ 40 μmol/L should be delivered at approximately 37 weeks
• Administer antenatal corticosteroids for fetal lung maturity for patients delivering before 37 0/7 weeks of gestation if not previously administered.
• Delivery should not be performed before 37 weeks of gestation in patients with a clinical diagnosis of ICP without a laboratory confirmation of elevated bile acid levels.
• Delivery between 34 and 36 weeks of gestation should be considered in women with ICP with total bile acid levels ≥ 100 μmol/L with any of the following
  o Excruciating and unremitting maternal pruritus not relieved with pharmacotherapy
  o A history of stillbirth before 36 weeks of gestation due to ICP with recurring ICP in the current pregnancy
  o Preexisting or acute hepatic disease with clinical or laboratory evidence of worsening hepatic function
REFERENCES


December 2021
PUERPERAL MASTITIS

Patrick Duff, M.D.

EPIDEMIOLOGY

Approximately 3 to 5% of women who breastfeed their infants develop mastitis. The principal organisms that cause this infection are staphylococci species and *Viridans streptococci*. Fissures in the nipple or periareolar area facilitate transmission of bacteria into the underlying milk ducts.

CLINICAL MANIFESTATIONS

- Fever
- Shaking chills
- Myalgias
- Arthralgias
- Axillary adenopathy
- Erythema, warmth, and tenderness in one of the quadrants of the breast

Serious complications of mastitis include sepsis and a breast abscess.

DIAGNOSIS

The diagnosis usually can be established on the basis of physical examination alone. In some instances, culture of the breast milk may be of value:

- Suspicion of sepsis at initial presentation
- Failure to respond promptly to oral antibiotic therapy
- Suspicion of breast abscess

TREATMENT

- The initial drug of choice for most patients is oral sodium dicloxacillin, 500 mg every 8 hours for 7 to 10 days.
• If the patient has a mild allergy to penicillin, oral cephalexin, 500 mg every 8 hours for 7 to 10 days, is the appropriate alternative.

• If the patient has a severe allergy to penicillin, the two drugs of choice are:
  o Trimethoprim-sulfamethoxazole double strength, one tablet orally twice daily for 7 to 10 days
  o Clindamycin, 300 mg orally every 8 hours for 7 to 10 days

• Patients who are seriously ill, especially if they are immunosuppressed, or who have a suspected breast abscess should be hospitalized and treated with intravenous vancomycin, 1 gram every 12 hours. Incision and drainage is necessary if an abscess is present.

REFERENCE

Oligohydramnios
Robert Egerman, M.D.

Frequency: 1% pregnancies preterm, 4% term

Definition: Largest vertical pocket < 2 cm or amniotic fluid index ≤ 5 cm [For multiple gestations use the largest vertical pocket.]

[The ultrasound probe must be perpendicular to the floor.] Amniotic fluid is important for lung development, normal fetal movement in prevention of deformations and avoiding umbilical cord compression.

Associations:
Maternal medical conditions or medications
Placental abruption or thrombosis/infarction
Rupture of membranes
Fetal causes
   Congenital abnormalities [urinary system 65%, CNS 5%, Skeletal 4%]
   Chromosomal abnormalities [8% in some series. If anomalies, consider trisomy 13 or triploidy]
   Infection [Cytomegalovirus, Toxoplasmosis, Rubella, herpes simplex virus, Parvovirus]
   Growth restriction
   Post term
   Twin-to-twin transfusion
Idiopathic

[As a general rule, oligohydramnios in the second trimester is related to a structural problem. In the third trimester, oligohydramnios is usually related to uteroplacental insufficiency or rupture of membranes.

Complications:
Low birth weight
Preterm delivery
Pulmonary hypoplasia
Limb contractures
Potter's sequence

Prognosis

*This is determined by the cause of oligohydramnios and the gestational age at delivery.*

<table>
<thead>
<tr>
<th>First trimester oligohydramnios</th>
<th>Typically, the outcome is poor [Offer serial exams for viability]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second trimester oligohydramnios</td>
<td>pPROM survival – approximately 20%</td>
</tr>
<tr>
<td></td>
<td>Abruption survival – approximately 20%</td>
</tr>
<tr>
<td></td>
<td>Idiopathic survival – approximately 20%</td>
</tr>
<tr>
<td>Third trimester oligohydramnios</td>
<td>Depends on underlying condition</td>
</tr>
<tr>
<td></td>
<td>Mostly favorable outcome</td>
</tr>
</tbody>
</table>

**Work up:**

Obtain history for rupture of membranes or bleeding
Obtain history regarding all medications including NSAIDs and antihypertensives
Confirm maternal blood pressure is normal
Assess for rupture of membranes
Determine fetal growth
Detailed sonogram [this may be limited due to lack of amniotic fluid]
If appropriate, offer maternal oral hydration
Amnio-infusion for fetal visualization or genetic testing may be considered in some cases
### Antenatal testing

<table>
<thead>
<tr>
<th>Condition</th>
<th>Gestational Age to Begin Testing</th>
<th>Frequency of Fetal Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oligohydramnios</td>
<td>At the time of diagnosis or the gestational age when delivery would be considered for abnormal results</td>
<td>Once or twice weekly</td>
</tr>
</tbody>
</table>

### Delivery

<table>
<thead>
<tr>
<th>Condition</th>
<th>General Timing</th>
<th>Suggested Specific Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oligohydramnios</td>
<td>Late preterm: 34 0/7 to 36 6/7 weeks Or Early term 37 0/7 to 38 6/7 weeks</td>
<td>36 0/7 to 37 6/7 weeks</td>
</tr>
</tbody>
</table>

### References

ACOG, UpToDate

November 2021
PARVOVIRUS INFECTION IN PREGNANCY

Patrick Duff, M.D.

EPIDEMIOLOGY

- Pathogen is the B19 parvovirus.
- Humans are the only known host.
- Infection is transmitted by respiratory droplets and infected blood products.
- Approximately 50-60% of women of childbearing age are immune to this infection.
- Incubation period is 10-20 days.

CLINICAL MANIFESTATIONS IN THE MOTHER

- Erythema infectiosum (Fifth Disease)
  - Slapped cheek facial rash
  - Erythematous, lace-like rash on trunk and extremities – not pruritic or painful
  - Low-grade fever
  - Arthralgias
  - Myalgias

- Transient Aplastic Crisis
  - More common presentation in children than in adults
  - Most likely to occur in adults with an underlying hemoglobinopathy
  - Presents with signs and symptoms of anemia – pallor, tachycardia, dyspnea, fatigue

MANIFESTATIONS IN THE FETUS

- The virus crosses the placenta and attacks red cell progenitors in the fetal marrow, resulting in a transient aplastic anemia.
- Although the infection is usually self-limited, the anemia may be severe enough to cause fetal hydrops.
- Hydrops may also be due to direct viral injury to the fetal myocardial cells.
- The virus also may damage platelet progenitors, resulting in fetal thrombocytopenia.

DIAGNOSIS IN THE MOTHER

- Acute infection is usually diagnosed by identifying a positive IgM assay, combined with a negative IgG assay and a positive serum PCR.
- If both the IgM and IgG tests are positive, the IgG avidity test may be helpful in differentiating between an acute versus a subacute infection. In the former, the avidity is low; in the latter, the avidity is usually higher.
DIAGNOSIS IN THE FETUS

- The risk of serious fetal injury is directly related to the gestational age at which maternal infection develops.
- If maternal infection occurs in the first 12 weeks of pregnancy, the risk of fetal hydrops varies from less than 5% to 10%.
- If maternal infection occurs during weeks 13-20, the risk of infection decreases to 5% or less.
- If infection occurs beyond the 20th week of gestation, the risk of fetal hydrops is 1% or less.
- The key diagnostic test is Doppler velocimetry of the fetal middle cerebral artery. If the peak systolic velocity is 1.5 MOM or greater, the fetus has moderate to severe anemia, and cordocentesis is indicated to directly assess the fetal hematocrit.
- MCA Doppler velocimetry should be performed weekly for 8 weeks after diagnosis of maternal infection because the incubation period in the fetus may be longer than in the adult.

MANAGEMENT OF THE MOTHER AND FETUS

- Supportive care (fluids, analgesics) are the appropriate care for the mother.
- In isolated instances, mothers have developed pre-eclampsia (mirror syndrome) when the fetus was hydropic.
- The fetus that has moderate to severe anemia should receive an intrauterine transfusion. Because the fetal infection is usually self-limited, only one transfusion is likely to be necessary.
- With appropriate treatment, long-term complications of congenital parovovirus infection are rare. In isolated instances, infants have demonstrated neurological morbidity (delayed psychomotor development) and/or prolonged transfusion-dependent anemia.

REFERENCE


January 2022
PLACENTA PREVIA

Patrick Duff, M.D.

EPIDEMIOLOGY

Placenta previa is defined as placental tissue over the cervical os. A low-lying placenta is defined as a placenta extending to within 2 cm of the internal cervical os. Although not a true previa, the low-lying placenta is associated with an increased risk of hemorrhage, and patients should be treated as if they have an actual previa.

In the second trimester, approximately 2 to 6% of pregnancies show evidence of placenta previa. However, over 90% of these previas resolve, and, at term, the frequency of previa is 1 in 200 to 300 pregnancies.

RISK FACTORS

- Prior history of placenta previa
- Prior history of uterine surgery, especially cesarean delivery
- Multiple gestation
- Increased maternal age
- Increased parity
- Smoking
- Uterine anomalies
- Assisted reproductive technology (ART)
  - ART also predisposes to vasa previa

CLINICAL PRESENTATION

Placenta previa typically presents with painless, bright red bleeding in the third trimester. The first bleeding episode is usually self-limited. Subsequent episodes may be distinguished by heavier and more sustained bleeding. The table below compares and contrasts the clinical presentation of placenta previa versus placental abruption.
<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>PREVIA</th>
<th>ABRUPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color of blood</td>
<td>Bright red</td>
<td>Dark red</td>
</tr>
<tr>
<td>Clotting of blood</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Uterine pain</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>FHR abnormalities</td>
<td>Less likely</td>
<td>More likely</td>
</tr>
<tr>
<td>Coagulation abnormalities</td>
<td>Less likely</td>
<td>More likely</td>
</tr>
</tbody>
</table>

**DIAGNOSIS**

The key to the diagnosis of placenta previa is ultrasound, both abdominal and vaginal. The latter may be invaluable in identifying a posterior low-lying placenta and vasa previa. If a previa or low-lying placenta is identified during the anatomic survey at 20-22 weeks, the examination should be repeated at 28 weeks and again at 34 weeks to determine if the abnormal placentation has resolved. A true central previa (placenta fills the entire lower uterine segment and is centrally positioned over the internal os) is very unlikely to resolve.

**MANAGEMENT**

- Hospitalize at the time of the initial bleeding episode.
- If the bleeding subsides and the following conditions are met, the patient can be discharged and followed expectantly as an outpatient:
  - Complete cessation of bleeding
  - Stable vital signs
  - Stable hemoglobin and hematocrit
  - Home is in close proximity to a hospital
  - Patient has reliable telephone service
  - Patient has reliable transportation
  - Patient has a support person who could provide emergency transportation
- If the patient remains stable, she should be scheduled for cesarean delivery at 36-37 weeks.
• The patient should receive a course of betamethasone at approximately 35 weeks in anticipation of the planned late-preterm/early-term cesarean delivery.
• If bleeding recurs, the patient should be re-hospitalized and earlier delivery should be strongly considered, depending upon the clinical situation.
• In anticipation of cesarean delivery, the patient should be typed and crossed for two units of packed red cells.

REFERENCE


December 2021
PLACENTAL ABRUPTION

Patrick Duff, M.D.

EPIDEMIOLOGY

Placental abruption (abruptio placentae) is defined as the premature separation of a normally implanted placenta prior to delivery of the fetus. The diagnosis is usually reserved for pregnancies that have advanced beyond 20 weeks gestation. The overall incidence of placental abruption in the U.S. is 1:100 births.

RISK FACTORS

- Prior history of abruption
- Increased maternal age
- Increased parity
- Multiple gestation
- Uterine anomalies
  - Congenital
  - Acquired
- Preterm premature rupture of the membranes
- Polyhydramnios → rapid uterine decompression following rupture of membranes
- Smoking
- Cocaine use
- Methamphetamine use
- Trauma
  - Motor vehicle crash
  - Intimate partner violence
  - Fall
- Hypertensive disorders
  - Chronic hypertension
  - Pre-eclampsia

CLINICAL MANIFESTATIONS

- Dark red bleeding
  - Concealed hemorrhage is possible
- Abdominal pain
- Uterine hypercontractility → tetanic uterine contractions
- Maternal tachycardia
- Fetal tachycardia
- Hypovolemia → hypotension → altered sensorium
DIAGNOSIS

- Primarily a clinical diagnosis
- Must be differentiated from placenta previa – see table in the Placenta Previa protocol
- Some patients will have evidence of a retroplacental hematoma on ultrasound
- The following laboratory studies should be performed to identify a coagulopathy:
  - Complete blood count → thrombocytopenia
  - Decreased serum fibrinogen concentration
  - Increased serum concentration of fibrin split products or d-dimer
  - Prolonged prothrombin time
  - Prolonged partial thromboplastin time

MANAGEMENT

- Continuously monitor the FHR to identify tachycardia (with associated diminished variability) and late decelerations.
- Type and cross for a minimum of two units of packed red blood cells.
- Order platelets, fresh frozen plasma, and cryoprecipitate if signs of coagulopathy are present.
- Some patients may progress rapidly to a vaginal delivery in the presence of an abruption, but most will require an urgent cesarean delivery.
- Make certain the pediatrician in attendance at the delivery knows that the neonate may have evidence of anemia and hypovolemia.

RECURRENCE

- If the abruption occurs in the absence of an identifiable risk factor and maternal transfusion is not necessary, the recurrence risk is approximately 10%.
- If the abruption occurs in the presence of an identifiable risk factor and the hemorrhage is so severe that the mother requires a blood transfusion and neonatal death ensues, the recurrence risk may approach 20%.

REFERENCE


December 2021
PLACENTA ACCRETA SPECTRUM (PAS)

Mehmet Genc, M.D.

WHAT IS IT?

- Placenta accreta spectrum (PAS) is a term used to describe abnormally adherent or invasive villous tissue.
- Abnormally adherent placenta, placenta accreta, describes villi in direct contact with the uterine myometrium without the intervening decidua layer.
- Abnormally invasive placenta denotes both placenta increta and percreta.
- Placenta increta indicates villi invading the myometrium, whereas the villi invade the total thickness of the myometrium with or without invading pelvic tissues, organs, and/or vasculature in cases of placenta percreta.

WHAT IS THE SIGNIFICANCE?
- PAS disorders are associated with significant maternal morbidity, more so with abnormal invasion than adhesion.
- Although salvage of the uterus may be attempted in selected cases, the standard of care is hysterectomy.
- PAS disorders are frequently associated with significant postpartum hemorrhage, necessitating transfusion of blood products; intentional or unintentional organ injury, necessitating surgical repair; prolonged hospital stay; and intensive care unit admission.
- Maternal death is the most tragic outcome, often caused by excessive blood loss.
- Delivery usually must be undertaken prematurely, resulting in neonatal morbidity.

**RISK FACTORS FOR PAS**

- Uterine scarring due to >3 obstetric and gynecologic procedures: 2% risk.
- Concurrent placenta previa and a history of uterine scarring:
  - One cesarean delivery: 11%,
  - Two cesarean deliveries: 39%,
  - Three cesarean deliveries: 61%
  - Four cesarean deliveries: 67%
• A previous history of retained placenta or products of conception that required manual and instrumental extraction and complicated by PPH often indicates a focally adherent placenta. In these cases, recurrent PAS rates as high as 28% have been reported.

• Cesarean scar pregnancies that reach the third trimester: 75%

**HOW DO YOU DIAGNOSE PAS BEFORE DELIVERY?**

• Board-certified maternal-fetal medicine specialists with access to patients' clinical information perform targeted obstetric sonography to examine the placental implantation.

• Endovaginal probe and Doppler interrogation are used as needed during placental evaluation.

• Sonography is deemed to be suggestive of PAS if the interpretation includes, at minimum, the phrase "cannot exclude PAS," and at least one of these sonographic findings are present:
  • Placenta lacunae
  • Increased vascularity
  • Loss of sonoluent space between the placenta and the uterine myometrium,
  • Disruption of bladder mucosa or myometrial interface
  • Invasion of pelvic structures
• The initial sonographic screening for PAS is preferably performed between 18 and 22 weeks' gestation (See figure below, node a).

• High-risk patients and those with suggestive imaging findings should be evaluated with sonography at least once more between 24 and 28 weeks.

• Pelvic MRI is reserved for those suspected of having an invasive placenta (increta and percreta) (node b) or for those in whom the placenta is located laterally or posteriorly and the sonographic interrogation is suboptimal.

WHAT IS THE APPROPRIATE PERIPARTUM MANAGEMENT?
- All patients with the above clinical risk factors and/or imaging findings should be referred to the UF Shands PAS team. Please contact the team's clinical navigator, Amy Mosely, RN via EPIC or by e-mail.

- Delivery for high-risk patients without imaging findings and third-trimester bleeding is planned between 37 0/7 and 38 6/7 weeks (node c).
• Otherwise, delivery is planned between 34 0/7 and 36 0/7 weeks for those with clinical risk factors and bleeding placenta previa (node d). Likewise, delivery for those diagnosed with the abnormally adherent placenta (accreta) antenatally is also planned between 34 0/7 and 36 0/7 weeks (node d).
• If an abnormally invasive placenta (increta or percreta) is suspected antenatally, delivery is planned between 34 0/7 and 35 0/7 weeks (node e).
• Intense treatment for anemia is instituted as soon as it is diagnosed.
• All mothers expected to deliver before 37 weeks should receive at least one course of antenatal steroids, preferably before 34 weeks.
• All patients with clinical risk factors and/or imaging findings should be managed in accordance with the standardized multidisciplinary protocol (nodes c, d, and e).
• Intraoperative blood salvage (i.e., use of the cell saver) should be readily available for these cases. The blood salvage is attempted after the delivery of the infant. Ensure leukofilter is available.
• Confirm availability of 4 U PRBCs in the OR before starting the surgery.
• Regional anesthesia, either epidural or combined spinal-epidural anesthesia, is the preferred method.
• Unfractionated heparin 5000 u is given subcutaneously at least 2 h after the regional anesthesia for intraoperative thromboprophylaxis
• The anesthesiologist will decide to convert from regional to general anesthesia on a case-by-case basis after the delivery of the fetus.

• The preferred surgical approach to patients in node c is a Pfannenstiel skin incision followed by a lower uterine segment incision for cesarean delivery.

• Before cesarean delivery of patients suspected of PAS disorders, the location of the placenta is mapped by sonography (nodes d and e).

• Patients should be positioned in the dorsolithotomy position using padded Allen stirrups.

• A vertical abdominal skin incision and vertical hysterotomy incision may be preferred to avoid disrupting the placenta and to gain enhanced surgical access to the pelvic organs.

• Following delivery of the infant, an oxytocin infusion should be started, and gentle traction should be applied to the umbilical cord unless placental invasion is clearly visible on the serosal surface of the uterus.

• If the placenta detaches and there is no significant hemorrhage, the cesarean is completed as usual.

• Delivery of patients with suspected invasive placenta is planned in a hybrid operating room, with fluoroscopy for interventional radiological procedures (node e).

• In all cases of suspected invasive placenta, bilateral catheterization of uterine arteries is performed under fluoroscopy.
• If the placental invasion is apparent on the serosal surface of the uterus or if the placenta fails to detach completely without adequate hemostasis, uterine artery embolization should be performed.

• Gynecologic oncology surgeons are on stand-by for hysterectomy and perform the procedure when indicated.

• The surgical approach requires visualization of the iliac vessels and mobilization of the ureters bilaterally.

• Care should be taken to avoid cystotomy or bladder resection while dissecting the bladder.

• Pictures of the attached placenta in relation to the uterus should be obtained for documentation.

• Unfractionated heparin, 5000 u twice daily, should be given subcutaneously 6 h after removal of the epidural catheter and 12 h after the surgery if the patient is hemodynamically stable and bleeding is not suspected.

• In the event of an unexpected PAS discovered upon entry into the abdominal cavity (this is most likely to be highly invasive placentation), delay the uterine incision until resources are available if the mother and the fetus are stable.

• A PAS check list (see the example below) is sent to all members of the PAS team as well as the residents before the planned delivery

• A monthly conference is held for planning the upcoming cases and conducting postoperative debriefings.
the placenta is located in a posterior superior right lateral position.

**Risk of MAP based on history alone:**

<table>
<thead>
<tr>
<th>Antenatal Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission plan: Admit day prior to surgery (admission on 12/16/21)</td>
</tr>
<tr>
<td>Antenatal corticosteroids: N/A</td>
</tr>
<tr>
<td>H/H: 13.6/39.4 on 12/9/21</td>
</tr>
<tr>
<td>Optimize Hb: N/A</td>
</tr>
<tr>
<td>COVID test: negative on 12/13/21</td>
</tr>
<tr>
<td>Last T&amp;S: O+, antibody negative on 12/9/21 in GNV lab</td>
</tr>
</tbody>
</table>

**Notifications/Referrals:**
- Gynecological surgeon:
- Trauma surgeon: Dr. Croft
- Anesthesiologist: will see on admission
- NICU: N/A
- Peds surgery: N/A
- Urology: N/A
- Interventional radiology: will see on admission
- Hematology: N/A

**Surgical Plan**
- Date of Surgery: FRIDAY, December XX – CONFIRMED AND POSTED
- Gestational age at time of surgery: 37w4d
- Location: HVN OR

- Anesthesia: Epidural for cesarean; General for hysterectomy
- Patient positioning: Supine
- Cystoscopy/Ureteric stenting: No
- Placenta mapping by MFM prior to prepping patient: Yes
- Skin incision: Pfannenstiel
- Uterine incision: Low transverse
- Postop VTE ppx: TBD
- Hysterectomy by GYN Oncology if placenta does not spontaneously detach, bilateral tubal ligation if hysterectomy not performed: declines BTL, wants to preserve fertility
- Infant Health Care Proxy: TBD
References


January 2022
### Antenatal Checklist for Suspected Morbidly Adherent Placenta

**Date:** XXXXXX  
**Name:** XXXXXX  
**MRN:** XXXXXX  
**Primary High Risk Obstetrician/Fellow:** Genc/Rodriguez

<table>
<thead>
<tr>
<th>History</th>
</tr>
</thead>
</table>
| **Age:** 37 yo  
**Parity:** G3P0111  
**Current GA:** 37w2d  
**EDC:** 1/3/2021  
**BMI:** 29.8 |

**Previous CS/uterine surgery (number/type):** H/o CS x 1 (for twins, reduced from triplets)  
**Desire for future fertility:** declines BTL, desires to preserve fertility  
**Episodes of antepartum hemorrhage:** N/A  
**Consents to blood products:** Consents signed 12/9/21  
**Prenatal complications:** H/o CS x 1 with difficulty finding plane between placenta and uterus requiring intraoperative consult from Dr. Wen, H/o PTD

<table>
<thead>
<tr>
<th>Imaging</th>
</tr>
</thead>
</table>
| **Placenta:** Posterior  
**Previa:** No  
**Sonographic signs of accreta:** Posterior placenta without previa but multiple lacunae present with laminar flow close to the chorionic surface of the placenta. Uteroplacental interface could not be assessed due to placental location and fetal position. Placenta accreta cannot be ruled out. MRI ordered to assess the placenta.  
**Sonographic signs of percreta:** N/A  
**MRI findings:** Findings concerning for PAS and placenta percreta involving the posterior lateral right wall of the placenta where there is loss of the T2 dark interface and presence of subplacental hypervascularity, as detailed above. Involvement of the mesentery and bowel cannot be adequately assessed on the basis of MRI and direct visualization with ultrasound is suggested for further evaluation. No definite evidence of placental involvement of the bladder as |
Polyhydramnios
Robert Egerman, M.D.

**Frequency:** 1-2% pregnancies

**Definition:** Largest vertical pocket ≥ 8 cm or amniotic fluid index ≥ 24 cm

<table>
<thead>
<tr>
<th></th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deepest pocket</td>
<td>8 – 11.9 cm</td>
<td>12 – 15.9 cm</td>
<td>&gt; 16 cm</td>
</tr>
<tr>
<td>Amniotic fluid index</td>
<td>24 – 29.9 cm</td>
<td>30 – 34.9 cm</td>
<td>&gt; 35 cm</td>
</tr>
</tbody>
</table>

**Associations:**

Idiopathic [most frequent cause in approximately 40% of all cases]

Structural anomalies: GI obstruction [esophageal or duodenal atresia, diaphragmatic hernia, neck mass]

Neuromuscular disorders: anencephaly, myotonic dystrophy

Genetic: Trisomy 18 or 21, Prader Willi, Bartter, Beckwith-Wiedemann, RASopathy [Noonan syndrome, Costello syndrome, AVM, neurofibromatosis type 1]

High cardiac output: Fetal tachyarrhythmia, anemia [alloimmunization, infection (Parvovirus, CMV)], sacrococcygeal teratoma, placental chorangioma

Twin-to-Twin Transfusion Syndrome

Maternal diabetes

 Macrosomia

Fetal hydrops

**Complications:**

pPROM

Preterm labor

Fetal malposition

Abruptio Placenta

Umbilical cord prolapse
Prolonged second stage of labor
Uterine atony postpartum

**Work up:**
See chart below
Assess for fetal anomalies
Obtain MCA velocity with severe polyhydramnios
Offer microarray with severe polyhydramnios

**Management of severe idiopathic polyhydramnios:**

*Severe dyspnea or abdominal discomfort with or without uterine irritability* -> amnioreduction

*Management of preterm labor: antenatal steroids as indicated, consider indomethacin 25 mg orally every 6 hours] for 48 hours for tocolysis and amniotic fluid- reducing effects if < 32 weeks gestation*

No tocolysis after 34 weeks
Antenatal glucocorticoids as indicated before 37 weeks

<table>
<thead>
<tr>
<th></th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal</td>
<td>Assess for diabetes</td>
<td>Assess for diabetes</td>
<td>Assess for diabetes</td>
</tr>
<tr>
<td>Fetal</td>
<td>Detailed fetal survey</td>
<td>Detailed fetal survey</td>
<td>Detailed fetal survey</td>
</tr>
<tr>
<td></td>
<td>Fetal growth</td>
<td>Cardiac anatomy</td>
<td>MCA velocity for anemia</td>
</tr>
<tr>
<td></td>
<td>Placenta for chorangioma</td>
<td>Position of hands for arthrogryposis syndromes</td>
<td>Genetic counseling</td>
</tr>
<tr>
<td>Ultrasound Components</td>
<td>Stomach size for esophageal atresia</td>
<td>Examine face, palate, neck and position of head for extension</td>
<td>Amniocentesis, send for microarray</td>
</tr>
<tr>
<td></td>
<td>Fetal kidneys for obstruction</td>
<td>Lower spine for sacrococcygeal teratoma</td>
<td>Amnioreduction if indicated</td>
</tr>
<tr>
<td></td>
<td>Continued on next column</td>
<td></td>
<td>Assess maternal CMP</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Check renal function and calcium</td>
</tr>
<tr>
<td>Fetal testing</td>
<td>None</td>
<td>Weekly at 34 weeks</td>
<td>Weekly at 32 weeks</td>
</tr>
<tr>
<td>Delivery</td>
<td>39 – 40 6/7</td>
<td>39 – 40 6/7</td>
<td>Induction at 37 weeks</td>
</tr>
</tbody>
</table>
References
ACOG, SMFM, UpToDate

November 2021
DIAGNOSIS AND MANAGEMENT OF POST-CESAREAN WOUND (SURGICAL SITE) INFECTION

Patrick Duff, M.D.

EPIDEMIOLOGY

Wound infection (surgical site infection) is one of the two most common postoperative complications of cesarean delivery. The frequency of wound infection varies with patient demographics, but with appropriate preventive measures, the rate should not exceed 5%. The principal microorganisms are those that cause endometritis, combined with the skin flora, i.e., streptococci and staphylococci species. The major risk factors for wound infection are low socioeconomic status, obesity, excessive blood loss, diabetes, immunosuppressive disorders, smoking, and poor surgical technique.

CLINICAL MANIFESTATIONS

Wound infections may take one of two forms:

- **Incisional abscess** – erythema, warmth, tenderness, and induration at the incision site, combined with purulent drainage
- **Cellulitis** – erythema, warmth, tenderness, and induration at the incision site, but without purulent drainage

DIAGNOSIS

- Usually established on the basis of physical examination
- In problematic cases, ultrasound or CT scan may be of value in identifying a collection of purulent material in the subcutaneous tissue.

MANAGEMENT

- **Incisional abscess**
  - Open and drain the wound, usually along its entire length
  - Inspect the wound carefully for evidence of fascial dehiscence
Add vancomycin, 1 gram IV every 12 hours, to the antibiotic regimen. Continue intravenous antibiotics until the patient has been afebrile and asymptomatic for at least 24 hours.

Allow the wound to heal by secondary intention OR reapproximate the wound when all evidence of inflammation has resolved.

**Cellulitis**

Add vancomycin, 1 gram IV every 12 hours to the antibiotic regimen. Continue intravenous antibiotics until the patient has been afebrile and asymptomatic for at least 24 hours.

Once the patient has responded well to intravenous vancomycin, she may be changed to oral trimethoprim-sulfamethoxazole, one double-strength tablet twice daily, to complete the course of therapy.

**PREVENTIVE MEASURES**

The following measures are of proven value in reducing the frequency of wound infection following cesarean delivery:

- Clip rather than shave the hair at the incision site
- Prepare the skin with chlorhexidine rather than povidone-iodine
- Close the deep subcuticular layer with a resorbable multi- or monofilament suture if the layer is more than 2 cm in thickness.
- Close the skin with a resorbable monofilament suture.
- If the patient's BMI exceeds 30, or she is otherwise at increased risk for a wound infection, apply a negative pressure wound dressing.

**REFERENCE**

POSTPARTUM EVALUATION CHECKLIST
Patrick Duff, M.D.

FOR ALL PATIENTS

- Inquire about status of the newborn
- Inquire about support system at home
  - Secure housing
  - Food security
- Inquire about adequacy of infant nutrition
- Assess for evidence of mastitis or milk duct engorgement
- Inquire about emotional well being of mother
  - Administer the Edinburgh Postpartum Depression Scale
- Determine the patient's preferred method of contraception
- Discuss desirable inter-pregnancy interval
  - 18 to 24 months
- Determine if pap test is indicated
- Determine if postpartum CBC is indicated in light of peripartum blood loss
- Assess BP, especially if patient had chronic hypertension or pre-eclampsia
- Measure weight

FOR PATIENTS HAVING A VAGINAL DELIVERY

- Inquire about perineal discomfort
  - Spontaneous
  - Associated with coitus
    - Lacerations
    - Dryness
- Inquire about urinary and fecal control
- Inquire about volume of vaginal bleeding
- Inspect perineum and vagina for healing of lacerations and/or episiotomy
- Evaluate tone of levator ani muscle
- Determine uterine size, symmetry, and mobility
- Assess for adnexal enlargement or tenderness
- Assess for healing of rectum if a 4th degree laceration occurred

FOR PATIENTS HAVING A CESAREAN DELIVERY

- Assess rectus abdominus tone
- Assess for incisional infection or poor approximation
- Remove remaining Dermabond if still present
- Review indication for cesarean delivery and discuss probability of successful trial of labor in following pregnancy

December 2021
POSTPARTUM HEMORRHAGE

OVERVIEW

UFL MANAGEMENT PLAN

GUIDELINES FOR BLOOD TRANSFUSION
POSTPARTUM HEMORRHAGE

Erica Smith, M.D.

EPIDEMIOLOGY

In the United States the leading cause of maternal death on the day of delivery is postpartum hemorrhage, accounting for 11% of fatalities. Fifty-four to 93% of these deaths are considered preventable.

DEFINITION

Postpartum hemorrhage is defined as a cumulative blood loss of greater than, or equal to, 1000 ml, or blood loss that is accompanied by clinical manifestations of hypovolemia, within 24 hours of delivery. The route of delivery does not impact the definition of postpartum hemorrhage. However, blood loss greater than 500 ml at the time of vaginal delivery should be considered abnormal and should prompt additional investigation to evaluate the cause.

ETIOLOGY

• Uterine atony
  o Over-distended uterus
    ▪ Polyhydramnios
    ▪ Multiple gestation
  o Uterine anomalies
    ▪ Congenital malformation
    ▪ Uterine myoma
  o Prolonged labor
  o Prolonged administration of oxytocin
  o Prolonged administration of magnesium sulfate
• Cervical laceration
  o Associated with precipitous delivery
• Vaginal laceration
  o Associated with precipitous delivery and instrumental delivery
• Retained placental fragments
• Adherent placenta  
  o Accreta  
  o Increta  
  o Percreta  
• Coagulopathy  
  o Severe pre-eclampsia  
  o Sepsis  
  o Amniotic fluid embolism  
  o Placental abruption  
  o Anticoagulant administration  
• Uterine inversion  

PREVENTIVE MEASURES

• Administer Pitocin immediately after delivery  
• Avoid excessive traction on the umbilical cord  
• Massage the uterus following delivery of the placenta  
• Have blood products and tranexemic acid readily available in high risk patients
OVERVIEW OF MANAGEMENT

<table>
<thead>
<tr>
<th>COMPLICATION</th>
<th>MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uterine atony</td>
<td>Administer oxytocin</td>
</tr>
<tr>
<td></td>
<td>Massage the uterus</td>
</tr>
<tr>
<td></td>
<td>Administer methergine</td>
</tr>
<tr>
<td></td>
<td>Administer prostaglandin F2alpha (Hemabate)</td>
</tr>
<tr>
<td></td>
<td>Insert Jada device (preferred over the Bakri balloon)</td>
</tr>
<tr>
<td></td>
<td>Uterine artery embolization</td>
</tr>
<tr>
<td></td>
<td>Perform surgery</td>
</tr>
<tr>
<td></td>
<td>Compressive suture such as B-Lynch stitch</td>
</tr>
<tr>
<td></td>
<td>Hysterectomy – supracervical or complete</td>
</tr>
<tr>
<td>Cervical and vaginal lacerations</td>
<td>Surgically repair the lacerations</td>
</tr>
<tr>
<td>Retained placental fragments</td>
<td>Perform surgical curettage</td>
</tr>
<tr>
<td>Adherent placenta</td>
<td>Perform hysterectomy</td>
</tr>
<tr>
<td>Coagulopathy</td>
<td>Administer isotonic crystalloid, packed cells, platelets, fresh frozen plasma, cryoprecipitate, and tranexamic acid, as indicated</td>
</tr>
<tr>
<td>Uterine inversion</td>
<td>Replace uterus</td>
</tr>
<tr>
<td></td>
<td>Correct hypovolemia</td>
</tr>
</tbody>
</table>

Please see the following **UFL Obstetric Hemorrhage Emergency Management Plan**

REFERENCES


November 2021
GUIDELINES FOR FLUID RESUSCITATION AND BLOOD TRANSFUSION

Patrick Duff, M.D.

CLASS OF HEMORRHAGE

<table>
<thead>
<tr>
<th>CLASS</th>
<th>VOLUME OF BLOOD LOSS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>&lt; 15% of blood volume</td>
<td>Minimal change in vital signs</td>
</tr>
<tr>
<td>II</td>
<td>15 – 30% of blood volume</td>
<td>Increased HR, RR Decreased urine output Change in mental status</td>
</tr>
<tr>
<td>III *</td>
<td>30 – 40% of blood volume</td>
<td>Marked hypotension Marked change in mental status</td>
</tr>
<tr>
<td>IV *</td>
<td>&gt; 40%</td>
<td>Severe hypotension Oliguria Vasoconstriction</td>
</tr>
</tbody>
</table>

*With stage III and IV hemorrhage, a patient can die within 1 to 1.5 hours if not properly treated.

FLUID RESUSCITATION

- Isotonic crystalloid is the preferred solution for fluid resuscitation.
  - Normal saline
  - Ringer's lactate
  - Plasmalyte
  - The latter two solutions are less likely to cause renal injury.
- Colloid offers no advantage over crystalloid and is more expense.
- Rule of thumb is 3 ml of crystalloid for each ml of estimated blood loss.
## BLOOD PRODUCT REPLACEMENT

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>INDICATIONS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packed red blood</td>
<td>Increase oxygen-carrying capacity in severely anemic patients</td>
<td>1 unit = 300 ml Hematocrit – approximately 70% 1 unit will raise the hematocrit by about 3 points</td>
</tr>
<tr>
<td>cells</td>
<td>Correct orthostatic hypotension secondary to blood loss</td>
<td>Warm the fluid Infuse with normal saline, not RL</td>
</tr>
<tr>
<td>Platelets</td>
<td>Patient is bleeding and platelet count is &lt; 50,000/mm3</td>
<td>Usual dose is 1 unit per 10 kg of weight 1 unit should increase the platelet count by 5000 to 10,000/mm3</td>
</tr>
<tr>
<td>Fresh frozen plasma</td>
<td>Widespread capillary bleeding DIC Reversal of sodium warfarin Massive transfusion may deplete coagulation factors</td>
<td>Volume = 250 ml/unit Dose – 1 unit/20 kg One unit will usually raise the fibrinogen concentration by 10mg/dl</td>
</tr>
<tr>
<td>Cryoprecipitate</td>
<td>Congenital and acquired deficiencies of fibrinogen and factor XIII Von Willebrand’s disease Uremic platelet dysfunction</td>
<td>Volume = 10-15 ml/unit 1 unit/5kg will increase fibrinogen to &gt; 100 mg/dl</td>
</tr>
</tbody>
</table>

Massive transfusion protocol will usually provide packed cells, fresh frozen plasma, and platelets in a ratio of 1:1:1.
TRANEXAMIC ACID

- Competitively inhibits plasminogen binding sites, thus decreasing plasmin formation and fibrinolysis
- Administer intravenously in a dose of 1000 mg
- May repeat once

GOALS OF FLUID RESUSCITATION AND BLOOD COMPONENT TRANSFUSION

- Establish and maintain hemoglobin concentration of 7 – 10 g/dl
- Maintain urine output of at least 30 ml/hour
- Increase fibrinogen to > 100 mg/dl
- Increase platelet count to > 50,000 mm\(^3\)
- Maintain PT and PTT < 1.5 x control
- Maintain normal arterial blood gas
- Avoid the “lethal triad”
  - Acidosis
  - Hypothermia
  - Coagulopathy

COMPLICATIONS OF BLOOD TRANSFUSION

<table>
<thead>
<tr>
<th>COMPLICATION</th>
<th>APPROXIMATE FREQUENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infection – HIV</td>
<td>1:1.2 million donors</td>
</tr>
<tr>
<td>Infection – HCV</td>
<td>1:1.4 million donors</td>
</tr>
<tr>
<td>Infection – HBV</td>
<td>1: 144,000 donors</td>
</tr>
<tr>
<td>Acute hemolytic reaction</td>
<td>1:250,000 to 1 million units</td>
</tr>
<tr>
<td>Severe anaphylaxis</td>
<td>1:25,000 to 1:50,000 units</td>
</tr>
<tr>
<td>Acute lung injury</td>
<td>1:5000 units</td>
</tr>
<tr>
<td>Febrile reaction</td>
<td>1%</td>
</tr>
</tbody>
</table>
REFERENCES


November 2021
Maternal Obstetric Hemorrhage Checklist

Complete all steps in prior stages plus current stage regardless of stage in which patient presents.

RECOGNITION:

☐ Call for additional assistance (OB/Anes), notify CN ☐ Notify Charge nurse on L&D (if event in MBU)

Designate: ☐ Team leader ___________ ☐ Checklist reader/recorder ___________ ☐ Primary RN ___________

Announce: ☐ Cumulative blood loss ___________ ☐ Vital sign ___________ ☐ Determine stage

STAGE 1: BLOOD LOSS > 500 mL vaginal OR blood loss > 1000 mL cesarean with normal vital signs and lab values.

INITIAL STEPS: Time: ___________

☐ Ensure 16G or 18 G IV access
☐ Initiate IV fluid (LR) & administer pre-mixed oxytocin as bolus
☐ Insert indwelling urinary catheter
☐ Fundal massage
☐ Examine vaginal walls, cervix, uterus, and placenta
☐ O2 to maintain sat >95%
☐ Consider discontinuing Magnesium Sulfate infusion *(Consult provider first)*

MEDICATIONS:

☐ Increase oxytocin: _______ units Time _______
☐ Uterotonic 1: methergine / hemabate / cytotec _______
☐ Uterotonic 2: methergine / hemabate / cytotec _______
☐ Uterotonic 3: methergine / hemabate / cytotec _______

BLOOD BANK: 733-0900/30900

☐ Type & Crossmatch 2 units PRBCs
☐ Consider activating Urgent Hemorrhage Protocol (3U RBC, 3U Plasma)

ACTION:

☐ Determine etiology and treat
☐ QBL with VS: Q 5-10 min:

  time: _______ HR _______ RR _______ BP _______ cc
  time: _______ HR _______ RR _______ BP _______ cc
  time: _______ HR _______ RR _______ BP _______ cc
  time: _______ HR _______ RR _______ BP _______ cc

  Cumulative total QBL ___________

☐ Ultrasound- retained placenta? ___________

☐ Prepare OR, if clinically indicated (optimize visualization/examination)

☐ Rapid Bleeding Labs (1) Tubed to Core Lab
  CBC (purple)
  Fibrinogen (blue)
  TEG (blue top)

Provide updates to patient’s family

Tone: (i.e. atony)
Trauma: (i.e. laceration)
Tissue: (i.e. retained products)
Thrombin: (i.e. coagulation dysfunction)

Oxytocin (Pitocin):
30 units per 500 mL solution

Misoprostol (Cytotec):
300-1000 micrograms PR
800 micrograms PO or 800 micrograms SL
Q. 8 hrs x 3 doses.

Methylergonovine (Methergine):
0.2mg IM *(if not severe hypertensive)*
May repeat 1 dose in 15 minutes if required for heavy bleeding.
May repeat Q 2-4 hr for maximum of 5 doses

15-methyl PGF2α (Hemabate, Carboprost):
250 micrograms IM
*(contraindicated with Asthma)*
May repeat in q15 minutes,
Maximum 8 doses.

BLOOD BANK 733-0900 (30900 ON ZEBRA)
EMERGENT: 2U CROSS-MATCHED RBC via pneumatic tube system
UNCROSS-MATCHED BLOOD Available in NT Dispense Station refrigerator (44744) 2nd floor – follow red arrows
URGENT PACK: 3 RBC/3 Plasma
MTP: 6 RBC/6 Plasma/Platelets every other cooler/Cryo with 2nd cooler for OB
STAGE 2: CONTINUED BLEEDING (EBL up to 1500 mL OR > 2 uterotonics) OR VS changes (by >15% or HR >110, BP < 85/45, O2 sat <95%)

INITIAL STEPS: Time: ______________________
☐ MBU- Transfer to L&D and/or
☐ L&D- Mobilize additional help- 2nd OB faculty, Anesthesiology, and/or SWAT
☐ Assign roles
   QBL with VS: Q 5 min:
   time: ______ HR ______ RR ______ BP ______ cc
   time: ______ HR ______ RR ______ BP ______ cc
   time: ______ HR ______ RR ______ BP ______ cc
   time: ______ HR ______ RR ______ BP ______ cc
☐ Place 2nd IV (16G)
☐ Draw STAT labs (2) (CBC, PT, PTT, INR, Fibrinogens) Time_______
☐ Fundal massage

MEDICATIONS:
☐ Continue stage 1 medications Time
   Uterotonic 1: methergine / hemabate / cytotec _________
   Uterotonic 2: methergine / hemabate / cytotec _________
   Uterotonic 3: methergine / hemabate / cytotec _________
☐ Second IVF with 40 U Pitocin
☐ Tranexamic Acid Time #1___________ Time #2___________

BLOOD BANK: 733-0900/30900
☐ 2 units RBCs (DO NOT wait for labs. Transfuse per clinical signs/symptoms)
   PRBC: Time #1___________ Time #2___________
☐ Transfuse 2 units Fresh Frozen Plasma (if transfuse > 2 u PRBC)
☐ Activate Urgent Hemorrhage Protocol or consider activating MTP

ACTION:
☐ Escalate therapy with goal of hemostasis
☐ Evaluate for Uterine inversion

VAGINAL BIRTH
☐ Preparation/Move to OR
☐ Foley catheter Time_______ Volume_________CC
☐ Repair any lacerations
☐ Dilatation & Curettage for retained placenta
☐ Place Jada or Intrauterine balloon *Volume____ Time____
☐ Notify Interventional Radiology- Embolization (IR 5-0116)
☐ Warm Blanket / Bear hugger

CESAREAN BIRTH
☐ Inspect broad ligament, posterior uterus and retained placenta
☐ Uterine Artery Ligation
☐ B-Lynch suture (#1 or #0 Chronic)
☐ Place Intrauterine balloon. Volume________ Time_______
☐ Warm Blanket / Bear hugger

Oxytocin (Pitocin): 30 units per 500 mL solution (1mu/min= 1 ml)
Misoprostol (Cytotec): 800-1000 micrograms PR
800 micrograms PO or 800 micrograms SL Q 8 hrs x 3 doses.
Methylergonovine (Methergine): 0.2mg IM
*(if not severe hypertensive)*
May repeat 1 dose in 15 minutes if required for heavy bleeding.
May repeat Q 2-4 hr for maximum of 5 doses
15-methyl PGF2alpha (Hemabate, CarboProst): *(contraindicated with Asthma)*
250 micrograms IM
May repeat in q15 minutes, maximum 8 doses.

Tranexamic Acid 1g/10ml IV over 10 min
(100 mg/mL at 1 mL/ min).
Administer within 3 hours of birth.
May repeat- if bleeding > 30 minutes or if stops and restarts within 24 hours.

BLOOD BANK
733-0900 (30900 ON ZEBRA)
EMERGENT: 2U CROSS-MATCHED RBC via pneumatic tube system
UNCROSS-MATCHED BLOOD
Available in NT Dispense Station refrigerator (44744)
2nd floor – follow red arrows
URGENT PACK: 3 RBC/3 Plasma
MTP: 6 RBC/6 Plasma/Platelets every other cooler/Cryo with 2nd cooler for OB

Huddle and move to stage 3 if necessary/ PROVIDE UPDATES TO PATIENT’S FAMILY
Stage 3: Continued Bleeding (FBL > 1500 mL OR > 2 U of PRBCs given OR at risk for occult bleeding/coagulopathy OR any patient with abnormal vital signs and lab values/oliguria).

Initial Steps: Time:

- Mobilize additional help
  - Advance Gyn surgeon
  - 2nd Anesthesia Providers
  - Adult Intensivist
- Move to OR
- Announce clinical status, cumulative blood loss, etiology

VS & QBL: continue
time: _____ HR _____ RR _____ BP _____ _____ cc
time: _____ HR _____ RR _____ BP _____ _____ cc
time: _____ HR _____ RR _____ BP _____ _____ cc
time: _____ HR _____ RR _____ BP _____ _____ cc

- Outline and communicate plan
- Repeat labs (CBC, PT, PTT, INR, Fibrinogens, BMP, ABG)
  Time ___________

Medications:

- Continue stage 1 medications/uterotonics
- Lasix 20-40 mg IV (after 4 units PRBC)
- Ancef prophylaxis- Re-dose if QBL > 1500 cc OR Surgery > 3 hours

Blood Bank: 733-0900/30900

- Activate MASSIVE TRANSFUSION PROTOCOL
  MBTP 1st cooler
  PRBC Time#1 _________ Time#2 _________
  Time#3 _________ Time#4 _________
  Time#5 _________ Time#6 _________
  FFP Time#1 _________ Time#2 _________
  Time#3 _________ Time#4 _________
  Time#5 _________ Time#6 _________
  Platelet Time#1 _________ Time#2 _________
  Time#3 _________ Time#4 _________
  MBTP 2nd cooler
  PRBC Time#1 _________ Time#2 _________
  Time#3 _________ Time#4 _________
  Time#5 _________ Time#6 _________
  FFP Time#1 _________ Time#2 _________
  Time#3 _________ Time#4 _________
  Time#5 _________ Time#6 _________
  Platelet Time#1 _________ Time#2 _________
  Time#3 _________ Time#4 _________
  Cryoprecipitate Time ____________

Oxytocin (Pitocin):
10-40 units per 500-1000 mL solution

Methylaergonovine (Methergine):
0.2 mg IM *(if not severe hypertensive)*
May repeat 1 dose in 15 minutes if required for heavy bleeding.
May repeat Q 2-4 hr for maximum of 5 doses

15-methyl PGF2α (Hemabate, Carboprost):
250 micrograms IM *(contraindicated with Asthma)*
May repeat in q15 minutes, maximum 8 doses

Misoprostol (Cytotec):
800-1000 micrograms PR
600 micrograms PO or 800 micrograms SL

Tranexamic Acid 1g/10ml IV over 10 min
(100 mg/mL at 1 mL/min).
Administer within 3 hours of birth.
May repeat - if bleeding > 30 minutes or if stops and restarts within 24 hours.

Lasix 20-40 mg IV after 4U PRBC
Ancef 2 gm IV QBL > 1500cc or surgery >3hrs
rFactor VIIa
40mcg/kg after second round of MTP

Blood Bank 733-0900 (30900 ON ZEBRA)

Emergent: 2U CROSS-MATCHED RBC via pneumatic tube system
Uncross-Matched Blood Available in NT Dispense Station refrigerator (44744) 2nd floor – follow red arrows

Urgent Pack: 3 RBC/3 Plasma
MTP: 6 RBC/6 Plasma/Platelets every other cooler/Cryo with 2nd cooler for OB
Consider rFactor VIIa after 2nd Course of MBTP Time___________

MBTP 3rd cooler

PRBC Time#1 __________ Time#2 __________ Time#3 __________ Time#4 __________
   Time#5 __________ Time#6 __________

FFP  Time#1 __________ Time#2 __________ Time#3 __________ Time#4 __________
   Time#5 __________ Time#6 __________

Platelet Time#1 __________ Time#2 __________ Time#3 __________ Time#4 __________

ACTION:

☐ Determine etiology and treat
☐ Prepare OR, if clinically indicated- surgery
☐ Central line / Arterial line: Time__________

☐ Laparotomy:
   ☐ B-Lynch Suture , Compression suture techniques
   ☐ Uterine Artery Ligation
   ☐ Hypogastric ligation
   ☐ Hysterectomy

☐ Patient support
   ☐ Fluid warmer
   ☐ Upper body warming device
   ☐ Sequential compression stockings

☐ Repeat lab: (CBC, PT, PTT, INR, Fibrinogens, BMP, ABG) Time __________

PROVIDE UPDATES TO PATIENT’S FAMILY
STAGE 4: CARDIOVASCULAR COLLAPSE (massive hemorrhage, profound hypovolemic shock, or amniotic fluid embolism).

INITIAL STEPS: Time: ______________________
☐ Mobilize additional resources- Rapid Response Team
☐ ACLS Crash Cart
☐ ______________________________________

☐ ______________________________________

MEDICATIONS:
☐ ACLS
☐ Respiratory Management medications

BLOOD BANK: 733-0900/30900
☐ Simultaneous aggressive Massive Transfusion

ACTION:
☐ Immediate surgical intervention to ensure hemostasis (hysterectomy)
☐ Stabilize airway and respiratory status per anesthesiology

BLOOD BANK 733-0900 (30900 ON ZEBRA)
EMERGENT: 2U CROSS-MATCHED RBC via pneumatic tube system
UNCROSS-MATCHED BLOOD Available in NT Dispense Station refrigerator (44744) 2nd floor – follow red arrows
URGENT PACK: 3 RBC/3 Plasma
MTP: 6 RBC/6 Plasma/Platelets every other cooler/Cryo with 2nd cooler for OB

Post- Resuscitation:

service

INITIAL STEPS:
☐ Repeat H/H or coagulation studies in 2 hr or 4 hr
☐ BMP and coagulation profile as indicated
☐ Monitor in L&D or ICU for 12-24 hours base on patient’s clinical status.
☐ Monitor strict I&O

MEDICATIONS:
☐ Uterine etiology- consider Methergine 200 mcg PO Q 4 hours x 5 doses
☐ Lasix 20-40 mg IV after 4 units of PRBC
☐ Consider Benadryl prophylaxis
☐ Consider Lomotil 1-2 tablets PO for diarrhea prevention.

BLOOD BANK: 733-0900/30900
☐ Cancel MTP when appropriate; Transfuse based on clinical status, VS and follow up H/H.

ACTION:
☐ Preparation for transfer to ICU
☐ Determine disposition of patient
☐ Debrief with the whole obstetric care team
☐ Debrief with patient and family
☐ Document
<table>
<thead>
<tr>
<th>Assessments</th>
<th>Meds/Procedures</th>
<th>Blood Bank</th>
</tr>
</thead>
</table>
| **Stage 3** is focused on the Massive Transfusion protocol and invasive surgical approaches for control of bleeding. | **Mobilize team** - Advanced GYN surgeon - 2nd Anesthesia Provider - OR staff - Adult Intensivist  
- Repeat labs including coags and ABG's  
- Social Worker/ family support | **Transfuse Aggressively Massive Transfusion Protocol** (Blood Bank 733-0900)  
(name/medical record number/location/attending name) and order and collect Type & Screen.  
**Massive Transfusion Protocol**  
6 units PRBC; 6 units FFP; 6 platelet apheresis pack  
**Round 2- Cryoprecipitate**  
**Unresponsive Coagulopathy:** After 8-10 units PRBCs and full coagulation factor replacement: may consult re Factor VIIa - 40 mcg/kg with second round of massive transfusion protocol. **Nurses' role**  
- Arrange for transport of MTP packs  
- Document temperature, vital signs  
- All PRBCs will be administered with a 140 micron filter using a blood warming device. Pumps may be used when increased flow is needed.  
- Draw stat CBC with platelets, PT/PTT/INR, fibrinogen, blood gas, electrolytes every 30 minutes, lab results are used to direct the need for additional products. **Physicians' role**  
- Monitoring the hemodynamic status of the patient with correction of hypotension, hypovolemia, hypothermia, hypocalcemia, hyperkalemia, electrolyte, osmolar, blood gas and acid-base disturbance.  
- When patient is stable - cancel EHP/MTP  
- Place all transfusion orders once MBTP has been terminated |
| **Total blood loss over 1500ml, OR >2 units PRBCs given, OR VS**  
OR suspicion of Disseminated Intravascular Coagulopathy | **Activate Massive Transfusion Protocol** (Blood Bank 733-0900)  
- Lasix 20-40 mg IV after 4 units of PRBC  
- Laparotomy:  
  - B-Lynch Suture  
  - Uterine Artery Ligation, Compression suture technique  
  - Hysterectomy  
  - Hypogastric ligation  
- Ancef prophylaxis - redose if EBL > 1500 cc or surgery > 3 hours  
- Patient support  
  - Fluid warmer  
  - Upper body warming device  
  - Sequential compression stockings |
<table>
<thead>
<tr>
<th>Stage 4</th>
<th>Assessments</th>
<th>Meds/Procedures</th>
<th>Blood Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cardiovascular Collapse (massive hemorrhage, profound hypovolemic shock or amniotic fluid emboli)</td>
<td>○ Mobilized additional resources - SWAT ○ ACLS crash cart</td>
<td>○ ACLS ○ Respiratory Management medications - stabilize airway and respiratory status (anesthesiology service) ○ Immediate surgical intervention to ensure hemostasis (Hysterectomy, B Lynch, Compression sutures) ○ Simultaneous aggressive massive transfusion</td>
</tr>
<tr>
<td></td>
<td>Post-resuscitation</td>
<td>○ Debrief - multidisciplinary team ○ Document checklist into Epic ○ Repeat H/H or coag studies in 2 hr or 4 hr ○ BMP and coag as indicated ○ Monitor in L&amp;D or ICU for 12-24 hours base on patient’s clinical status.</td>
<td>○ Uterine etiology - consider Methergine 200 mcg PO Q/4 hours x 5 doses ○ Lasix 20-40 mg IV after 4 units of PRBC ○ Consider Benadryl prophylaxis ○ Consider Lomotil for diarrhea</td>
</tr>
</tbody>
</table>
GESTATIONAL HYPERTENSION AND PREECLAMPSIA

Patrick Duff, M.D.

DEFINITIONS

Mild Gestational Hypertension
- Systolic BP greater than or equal to 140 mm Hg but less than 160 mm Hg
- Diastolic BP greater than or equal to 90 mm Hg but less than 110 mm Hg
- These pressures must be observed on at least two occasions 4 hours apart but no more than 7 days apart
- Proteinuria of < 300 mg per 24-h collection
- Platelet count > 100,000/mm3
- Normal liver enzymes
- No maternal symptoms
- No evidence of fetal growth restriction or oligohydramnios

Preeclampsia is gestational hypertension plus proteinuria or presence of symptoms/signs of preeclampsia, such as headache, visual changes, hemoconcentration, thrombocytopenia, and hepatic dysfunction.

The key to clinical decision-making is distinguishing between preeclampsia and preeclampsia with severe features.
- Systolic BP greater than 160 mm Hg or diastolic BP greater than 90 mm Hg at least 4 hours apart while the patient is at bedrest or once if the patient has already received intravenous antihypertensive therapy.
- New-onset cerebral symptoms such as headache or visual disturbances (scotoma, scintillations)
- Impaired liver function – RUQ pain or elevated liver enzymes
- Pulmonary edema
- Thrombocytopenia
- Progressive renal insufficiency (serum creatinine > 1.1 mg/dL) in the absence of preexisting renal disease

PRINCIPAL RISK FACTORS FOR PREECLAMPSIA
- Nulliparity
- Age > 40 years
- ART
- Interpregnancy interval greater than 7 years
- Positive family history
- Preeclampsia in prior pregnancy
• Multiple gestation
• Fetal growth restriction
• Placental abruption
• Fetal death
• Chronic hypertension
• Chronic renal disease
• Type 1 diabetes
• APLS
• Factor V Leiden mutation

MANAGEMENT

Preeclampsia Without Severe Features

• Expectant management until 37 weeks, then delivery
• Frequent BP monitoring
• Oral agents such as labetalol or nifedipine may be used to control mild BP elevations.
• Antenatal fetal testing – NST, AFI, umbilical artery Doppler velocimetry
• Serial ultrasounds to rule out growth restriction

Preeclampsia with Severe Features

• Treatment is usually immediate delivery.
• May temporize for 48 hours to allow administration of betamethasone.
• Method of delivery depends upon multiple factors, including, gestational age, prior history of cesarean delivery, severity of complications such as thrombocytopenia or pulmonary edema, fetal presentation, fetal status, and Bishop score.
• BP must be controlled below 160 mm Hg systolic and 110 mm Hg diastolic with antihypertensive agents. The two preferred agents are labetalol (20, 40, and 80 mg intravenously every 10 minutes for a maximum dose of 140 mg) or hydralazine (5-10 mg intravenously every 20 minutes for a maximal dose of 20 mg in 60 minutes).
• Magnesium sulfate should be administered to prevent seizures. The usual loading dose is 4-6 grams over 30-60 minutes, followed by a maintenance infusion of 2-4 grams per hour, titrated to depress the DTRs.
• Fluid administration must be carefully monitored during labor to ensure adequate urine output (30 ml/h) but to avoid fluid overload resulting in pulmonary edema.
• Be vigilant for unusual complications such as HELLP, pulmonary edema, acute kidney injury, and hepatic rupture.
• Patients with preeclampsia with severe features may require prolonged antihypertensive therapy postpartum (2-4 weeks). The preferred
agents are oral labetalolol (200 – 400 mg twice to three times daily) or long-acting nifedipine (30-60 mg once to twice daily).

PREVENTION OF RECURRENCE

- Effectively control co-morbidities such as chronic hypertension, renal disease, or autoimmune disorder.
- Screen for APLS in subsequent pregnancy, and, if diagnosed, treat with enoxaparin and low-dose aspirin.
- Administer low-dose aspirin (usually 81 mg daily) to all patients with a prior history of preeclampsia unless there is a contraindication to this agent.

REFERENCE


January 2022
PRENATAL CARE

Patrick Duff, M.D.

GOALS OF PRENATAL CARE

- Date the gestation accurately.
- Identify maternal medical and/or surgical conditions that may have an adverse effect on the pregnancy.
- Identify abnormalities that may adversely affect fetal development.
  - Genetic
  - Anatomic
  - Infection

USUAL FREQUENCY OF PRENATAL APPOINTMENTS

<table>
<thead>
<tr>
<th>MATERNAL CONDITION</th>
<th>APPROXIMATE FREQUENCY OF APPOINTMENTS *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk</td>
<td>Monthly until 36 weeks Then, weekly</td>
</tr>
<tr>
<td>Intermediate risk</td>
<td>Monthly until 28 weeks Then, every 2 weeks until 36 weeks Then, weekly</td>
</tr>
<tr>
<td>High risk</td>
<td>Monthly until 20 weeks Then, every 2 weeks until 28 weeks Then, weekly</td>
</tr>
</tbody>
</table>

*Some patients may be at such high risk (e.g., a patient with poorly controlled insulin-dependent diabetes) that they require weekly appointments even early in gestation.
### KEY TESTS AT DIFFERENT STAGES OF PREGNANCY

<table>
<thead>
<tr>
<th>STAGE OF PREGNANCY</th>
<th>APPROPRIATE TESTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>First appointment</td>
<td>CBC&lt;br&gt;Type, Rh, and antibody screen&lt;br&gt;HIV&lt;br&gt;Rubella&lt;br&gt;Syphilis&lt;br&gt;Hepatitis B and C&lt;br&gt;Urine culture</td>
</tr>
<tr>
<td>10 weeks or greater</td>
<td>Non-invasive prenatal screening (NIPS)</td>
</tr>
<tr>
<td>11–14 weeks</td>
<td>First trimester ultrasound screen</td>
</tr>
<tr>
<td>20-22 weeks</td>
<td>Anatomic survey</td>
</tr>
<tr>
<td>28 weeks</td>
<td>Repeat first trimester labs and perform 1 hGCT&lt;br&gt;Administer Tdap&lt;br&gt;Administer Rh-immune globulin, if indicated</td>
</tr>
<tr>
<td>36-37 weeks</td>
<td>Perform GBS culture</td>
</tr>
</tbody>
</table>

### KEY ASSESSMENTS AT EACH PRENATAL APPOINTMENT
- Measure blood pressure
- Determine weight gain since last appointment and total weight gain
- Measure fundal height
- Measure fetal heart rate
- Assess for excessive edema – pretibial, face, hands
- Perform urinalysis
  - pH
  - Leukocyte esterase
  - Nitrites
  - Protein
  - Glucose

December 2021
PRETERM DELIVERY

Patrick Duff, M.D.

EPIDEMIOLOGY

Preterm delivery, defined as delivery before 37 weeks gestation, occurs in approximately 10% of all pregnancies in the United States. Complications of preterm delivery are responsible for almost 75% of all neonatal deaths, once anomalies incompatible with life are excluded.

ETIOLOGY

The etiology of preterm delivery is complex and multifactorial and includes:

- Prior history of preterm delivery
- Multiple gestation
- Fetal anomalies
  - Placental abnormalities
    - Placenta previa
    - Placental abruption
  - Uterine anomalies
    - Congenital
    - Acquired
- Trauma
  - Motor vehicle crash
  - Intimate partner violence
  - Falls
- Smoking
- Drug use
  - Cocaine
  - Methamphetamine
- Genital tract infection
  - Bacterial vaginosis
  - Group B streptococcal infection
  - Gonorrhea
  - Chlamydia
• Acute respiratory tract infection
• Acute pyelonephritis
• Serious systemic illness
• Low body weight and low weight gain during pregnancy
• Polyhydramnios
• Preterm premature rupture of membranes

NEONATAL COMPLICATIONS OF PRETERM DELIVERY

• The four major causes of neonatal death in preterm infants are listed below, and they are of principal concern at gestational ages < 32 weeks.
  o Respiratory distress syndrome
  o Intraventricular hemorrhage
  o Necrotizing enterocolitis
  o Sepsis
• Other serious short-term complications of preterm delivery include:
  o Fluid and electrolyte abnormalities
  o Hyperbilirubinemia
  o Hypoglycemia
  o Renal dysfunction
  o Impaired temperature regulation
  o Poor feeding
  o Patent ductus arteriosus
  o Apnea and bradycardia spells
• Intermediate and long-term complications include:
  o Bronchopulmonary dysplasia
  o Retinopathy of prematurity
  o Developmental delays
  o Learning disabilities
  o Cerebral palsy
DIAGNOSIS OF PRETERM LABOR

- Gestational age < 37 weeks
- Regular uterine contractions
- Progressive effacement and dilation of the cervix leading to descent of the presenting part into the birth canal

IMMEDIATE EVALUATION OF THE PATIENT WITH PRETERM LABOR

- Detailed history and physical examination to identify risk factors for preterm delivery
- Complete blood count
- Urinalysis and urine culture
- Urine drug screen
- NAAT for gonorrhea and chlamydia
- Screening test for BV
  - Vaginal pH
  - Amine test
  - Wet prep
- GBS culture – swab of lower vagina, perineum, and perirectal area
- Ultrasound
  - Assess for multiple gestation
  - Assess estimated fetal weight
  - Determine location of the placenta
  - Assess amniotic fluid volume
  - Identify fetal anomalies known to be associated with preterm delivery, such as:
    - Open neural tube defects
    - Open abdominal wall defects
    - Upper GI atresias
ACUTE TREATMENT OF PRETERM LABOR WITH INTACT MEMBRANES

- Administer course of betamethasone
  - 12 mg IM initially; repeat in 24 hours
- Administer tocolytic

<table>
<thead>
<tr>
<th>DRUG</th>
<th>DOSE</th>
<th>PRINCIPAL ADVERSE EFFECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nifedipine</td>
<td>20 mg p.o. initially, then 10 mg every 6 hours for 48 hours</td>
<td>Hypotension Headache</td>
</tr>
<tr>
<td>Magnesium sulfate</td>
<td>4 grams i.v. over one hour, then 1-2 grams/hour continuously to maintain effect</td>
<td>Muscle weakness Decreased deep tendon reflexes Diplopia Circumoral paresthesias Respiratory depression</td>
</tr>
<tr>
<td>Indomethacin</td>
<td>25 mg p.o. every 6 hours</td>
<td>Maternal GI upset Stricture of fetal ductus arteriosus Oligohydramnios</td>
</tr>
<tr>
<td>Terbutaline</td>
<td>May be given in varying doses by oral, subcutaneous, or intravenous route</td>
<td>Tachycardia Tremor Hypokalemia Hyperglycemia Lactic academia Salt and water retention→ pulmonary edema</td>
</tr>
</tbody>
</table>

- If delivery is prevented, the patient may be discharged to self-care at home, provided that an appropriate support structure is in place (support person, telephone, reliable transportation).
- The patient should have follow-up appointments in the Preterm Labor Clinic.
- Activity at home should be limited.
SURVEILLANCE OF THE PATIENT AT INCREASED RISK FOR PRETERM DELIVERY

- Patients identified as high risk for preterm labor should be referred to our department’s special Preterm Labor Clinic, supervised by Dr. Genc.
- Patients with a history of prior preterm delivery, with or without preterm rupture of membranes, should receive a tablet of intravaginal micronized progesterone (Prometrium), 200 mg, each evening.
- Patients should have a cervical length assessment at 16 weeks, 20 weeks, and 24 weeks.
- If the cervical length shortens to < 25 mm despite treatment with micronized progesterone, a cerclage should be performed if the patient is < 24 weeks gestation.
- Patients should be screened for lower genital tract infection and treated, if positive:
  - Bacterial vaginosis
  - Gonorrhea
  - Chlamydia
- Screening for GBS should be performed at the time of admission for preterm labor.
- Patients should be advised to avoid strenuous exercise, but normal activities of daily living are usually acceptable.

REFERENCE


December 2021
Preterm premature rupture of membranes (PPROM) occurs in up to 3% of pregnancies. The principal risk factors for PPROM are history of PPROM in a prior pregnancy, genital tract infection, antepartum bleeding, and cigarette smoking. Most patients, however, have no obvious predisposing risk factor.

The classic presentation is a sudden gush of clear or pale yellow fluid from the vagina. Some patients describe leaking only small amounts of fluid either continuously or intermittently. Some just describe a sensation of abnormal wetness within the vagina or on the perineum. Membrane rupture may or may not be accompanied by uterine contractions. The earlier in gestation that membrane rupture occurs, the longer is the latent period between rupture and onset of labor.

Diagnosis

- Detection of pooling of amniotic fluid in the vagina
- Diminished to absent fluid on ultrasound examination
- Positive nitrazine test
- Positive fern test
- For problematic cases
  - AmniSure – detects placental alpha microglobulin-1 in amniotic fluid
  - ROM Plus – detects placental protein 12 and alphafetoprotein in amniotic fluid

Management

- There are two basic approaches to management: immediate delivery versus expectant management. All affected patients should be hospitalized.
The principal complications associated with expectant management are ascending infection, cord accident, and placental abruption.

The principal complications associated with immediate delivery are neonatal respiratory distress syndrome, intraventricular hemorrhage, necrotizing enterocolitis, and sepsis. These pose a significant risk of neonatal mortality at gestational ages below 34 weeks.

Therefore, if the patient is at 34 weeks or greater and the dates are certain, delivery is usually indicated. The mode of delivery will depend upon the patient’s obstetric history, fetal presentation, and cervical examination.

If the dates are not certain, or the patient declines early delivery, the pregnancy may be extended to 36 weeks by the best estimate of dates if the fetus and mother remain stable.

Regardless of gestational age, if the fetus or mother is unstable, delivery is indicated.

- Unstable presentation such as a footling breech with advanced cervical dilation (> 3-4 cm)
- Non-reassuring fetal heart rate tracing
- Evidence of chorioamnionitis

If the gestational age is < 34 weeks and fetus and mother are stable, expectant management is indicated.

- Admit to antepartum ward
- Culture/test for gonorrhea, chlamydia, trichomonas, and bacterial vaginosis
- Treat with therapeutic antibiotics if lower genital tract infection is identified
- Additional interventions are listed in the summary table on page 3
<table>
<thead>
<tr>
<th>INTERVENTION</th>
<th>OBJECTIVE OF TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Administer betamethasone</td>
<td>Reduce frequency of RDS, IVH, and NEC</td>
</tr>
<tr>
<td>Administer prophylactic antibiotics</td>
<td>Reduce frequency of neonatal and maternal infection</td>
</tr>
<tr>
<td>Ampicillin – 2 grams IV Q 6 h x 48 hours, then oral amoxicillin, 875 mg twice daily or 500 mg three times daily for 5 days Azithromycin – 1 gram orally upon admission</td>
<td></td>
</tr>
<tr>
<td>Administer tocolysis if patient is in preterm labor Magnesium sulfate for both tocolysis and neuroprotection if gestational age is &lt; 32 weeks Nifedipine if gestational age is &gt; 32 weeks</td>
<td>Delay delivery for 48 hours to obtain the beneficial effects of corticosteroids. Once steroid course is completed, patient should be delivered because the presence of labor in association with ROM strongly suggests subclinical infection.</td>
</tr>
<tr>
<td>Monitor for infection</td>
<td>Assessment of maternal temperature 3 to 4 times daily Serial WBCs at least weekly</td>
</tr>
<tr>
<td>Monitor for cord compromise</td>
<td>Daily NSTs to assess for repetitive variable decelerations</td>
</tr>
</tbody>
</table>

REFERENCE: Duff P. Preterm prelabor rupture of membranes: clinical manifestations and diagnosis AND Management and Outcome. UpToDate, 2021.
SHOULDER DYSTOCIA

Patrick Duff, M.D.

DEFINITION

Shoulder dystocia is determined to have occurred when delivery of the fetal shoulder fails after initial traction maneuvers and when ancillary maneuvers are required to effect delivery. Typically, in such a situation, the interval from head-to-body delivery will exceed 60 seconds.

RISK FACTORS

- Fetal macrosomia
  - Maternal gestational diabetes
  - Maternal obesity
  - Excessive pre-gravid weight
  - Excessive weight gain during pregnancy
- Prolonged second stage of labor
  - Particularly in a multigravida patient
- Prior history of shoulder dystocia
  - Recurrence risk is approximately 10%
- Most instances of shoulder dystocia occur in the absence of any of these risk factors.

CLINICAL MANIFESTATION

The classic presentation of shoulder dystocia is the turtle sign - the fetal head delivers and then immediately retracts back against the perineum.

MANAGEMENT

- Shoulder dystocia should be anticipated if any of the conditions listed above are present.
- If shoulder dystocia is anticipated, delivery should occur in the obstetric operating room rather than the labor room.
o At least three members of the Obstetrics team should be present, along with one of the anesthesiologists and neonatologists

• If shoulder dystocia is identified, the following steps should be taken, in sequence and repeated, as needed:
  o One observer keeps a detailed record of the delivery process and the timing of each maneuver used for extraction
  o Exert downward traction on the fetal head
    ▪ Pull straight toward the floor, not outward
  o Simultaneously, place the patient in the McRoberts position
  o Have one assistant exert suprapubic pressure
  o Perform a large mediolateral episiotomy
  o Attempt to rotate the head 45 degrees in either direction into the oblique plane
  o Attempt to rotate the shoulders 180 degrees (Woods corkscrew maneuver)
  o Attempt delivery of the posterior arm
  o Place the patient in the Gaskin position
  o Attempt cephalic replacement (Zavanelli maneuver) and, if successful, proceed to cesarean delivery
  o Perform an abdominal “rescue”
    ▪ One surgeon performs a hysterotomy incision and pushes down on the impacted shoulder from above while the second surgeon completes the delivery from below.
- **POSSIBLE INJURIES TO THE NEONATE**

<table>
<thead>
<tr>
<th>INJURY</th>
<th>MECHANISM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brachial plexus</td>
<td>Downward traction on head</td>
</tr>
<tr>
<td>Fractured clavicle</td>
<td>Collapse of the shoulders inward as delivery occurs</td>
</tr>
<tr>
<td>Injury to subclavian vein or artery</td>
<td>Vascular trauma from the broken clavicle</td>
</tr>
<tr>
<td>Injury to lung</td>
<td>Trauma from the broken clavicle</td>
</tr>
<tr>
<td>Fractured humerus</td>
<td>Trauma from delivery of the posterior arm</td>
</tr>
<tr>
<td>Hypoxic brain injury</td>
<td>Excessive delay in delivery</td>
</tr>
</tbody>
</table>

**REFERENCE**


December 2021
MANAGEMENT OF SYPHILIS IN PREGNANCY

Patrick Duff, M.D.

EPIDEMIOLOGY

Syphilis is caused by the spirochete bacterium, *Treponema pallidum*. The infection is highly contagious and is transmitted primarily by sexual contact and transplacentally, from infected mother to fetus. The principal risk factors for syphilis are younger age, multiple sexual partners, and concurrent sexually transmitted infections, particularly HIV.

CLASSIFICATION

Syphilis is divided into the following classes or stages:
- Primary syphilis
- Secondary syphilis
- Latent syphilis
  - Early - infection < 1 year
  - Late - infection > 1 year
  - Undetermined duration
- Tertiary
  - Cardiac disease
  - Skin lesions - gumma
- Neurosyphilis

CLINICAL MANIFESTATIONS OF MATERNAL INFECTION

<table>
<thead>
<tr>
<th>Class/Stage of Syphilis</th>
<th>Characteristic Manifestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Painless chancre on genitalia, lip, or oral mucosa</td>
</tr>
<tr>
<td>Secondary</td>
<td>Papular erythematous rash on palms and soles</td>
</tr>
<tr>
<td></td>
<td>Mucous patches</td>
</tr>
<tr>
<td></td>
<td>Condyloma lata</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>Aortitis – may predispose to dissection of aortic root</td>
</tr>
<tr>
<td>Central Nervous System</td>
<td>Cognitive abnormalities</td>
</tr>
<tr>
<td></td>
<td>Tabes dosalis</td>
</tr>
<tr>
<td></td>
<td>Argyll-Robertson pupil</td>
</tr>
</tbody>
</table>
## RISK OF PERINATAL TRANSMISSION IN ABSENCE OF EFFECTIVE TREATMENT

<table>
<thead>
<tr>
<th>Class/Stage of Syphilis</th>
<th>Risk of Perinatal Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary or secondary</td>
<td>50%</td>
</tr>
<tr>
<td>Early latent</td>
<td>40%</td>
</tr>
<tr>
<td>Late latent and tertiary</td>
<td>10%</td>
</tr>
</tbody>
</table>

## MANIFESTATIONS OF CONGENITAL SYPHILIS

<table>
<thead>
<tr>
<th>Stage of Congenital Infection</th>
<th>Principal Clinical Manifestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early (&lt; age 2 years)</td>
<td>Maculopapular rash → vesicles and bullae</td>
</tr>
<tr>
<td></td>
<td>Mucous patches</td>
</tr>
<tr>
<td></td>
<td>Hepatosplenomegaly</td>
</tr>
<tr>
<td></td>
<td>Jaundice</td>
</tr>
<tr>
<td></td>
<td>Lymphadenopathy</td>
</tr>
<tr>
<td></td>
<td>Osteochondritis</td>
</tr>
<tr>
<td></td>
<td>Chorioretinitis</td>
</tr>
<tr>
<td></td>
<td>Iritis</td>
</tr>
<tr>
<td>Late (&gt; age 2)</td>
<td>Hutchinson teeth</td>
</tr>
<tr>
<td></td>
<td>Mulberry molars</td>
</tr>
<tr>
<td></td>
<td>Interstitial keratitis</td>
</tr>
<tr>
<td></td>
<td>Eighth nerve deafness</td>
</tr>
<tr>
<td></td>
<td>Saddle nose</td>
</tr>
<tr>
<td></td>
<td>Rhagades</td>
</tr>
<tr>
<td></td>
<td>Saber shins</td>
</tr>
<tr>
<td></td>
<td>Mental retardation</td>
</tr>
<tr>
<td></td>
<td>Ventriculomegaly</td>
</tr>
<tr>
<td></td>
<td>General paresis</td>
</tr>
<tr>
<td></td>
<td>Optic nerve atrophy</td>
</tr>
<tr>
<td></td>
<td>Clutton joints</td>
</tr>
</tbody>
</table>
DIAGNOSIS

- **Darkfield microscopy** of scrapings from a visible lesion such as a chancre (primary syphilis) or gumma (tertiary syphilis)
  - This technology is not widely available
- **Direct fluorescent antibody smear** of lesion exudate
- **Serology - the "reverse algorithm"**
  - *T. pallidum* antibody test ➔ negative ➔ patient is uninfected
  - *T. pallidum* antibody test ➔ positive ➔ RPR ➔ positive ➔ patient is infected
    - RPR negative or indeterminate ➔ *T. pallidum* particle agglutination test (TP-PA) ➔ negative ➔ patient is not infected
    - RPR negative or indeterminate ➔ TP-PA is positive ➔ patient is infected, but this sequence of testing does not differentiate between previous versus new infection. A detailed history should be taken to determine if patient was previously infected and, if so, was treated appropriately.
- **Ultrasound** is the best modality to identify findings of congenital syphilis
  - Enlarged, edematous placenta
  - Microcephaly
  - Ventriculomegaly
  - Fetal growth restriction
  - Fetal death in utero

TREATMENT

The only drug with proven effectiveness for both maternal and fetal infection is penicillin. Patients with a penicillin allergy should be desensitized and then treated with penicillin.
<table>
<thead>
<tr>
<th>Class/Stage of Syphilis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary, secondary, and early latent</td>
<td>Benzathine penicillin G, 2.4 million units IM in a single dose</td>
</tr>
<tr>
<td>Late latent, latent syphilis of undetermined duration, and tertiary syphilis</td>
<td>Benzathine penicillin G, 2.4 million units IM weekly x 3 doses</td>
</tr>
<tr>
<td>Neurosyphilis</td>
<td>Aqueous crystalline penicillin G, 18-24 million units daily, administered as 3-4 million units IV q 4 hours or by continuous infusion for 10-14 days OR Procaine penicillin, 2.4 million units IM daily plus probenecid 500 mg orally four times daily, both for 10-14 days</td>
</tr>
</tbody>
</table>

**REFERENCE**

TOXOPLASMOsis IN PREGNANCY

Patrick Duff, M.D.

EPIDEMIOLOGY

Toxoplasmosis is caused by the protozoan, *Toxoplasma gondii*. The organism has three distinct life forms: trophozoite, cyst, and oocyst. The life cycle of the organism is dependent upon feral and domestic cats, which are the only known host for the oocyst. The oocyst is formed in the intestine of the cat and, subsequently, is excreted in the cat’s feces. Mammals such as cows ingest the oocyst, which is disrupted in the animal’s intestine, releasing the invasive trophozoite. The trophozoite is then disseminated throughout the body, ultimately forming cysts in the brain and muscle. Thus, the two key mechanisms of transmission of the organism are through contact with contaminated cat excrement and through eating improperly cooked beef or pork.

Next to CMV, toxoplasmosis is one of the most commonly transmitted perinatal infections. The frequency of seroconversion during pregnancy is 5%, and 3 of 1000 infants show evidence of congenital infection.

CLINICAL MANIFESTATIONS IN THE MOTHER

- Most infections in immunocompetent adults are asymptomatic.
- Symptomatic infection usually manifests as an illness similar to mononucleosis.
- In immunosuppressed patients, such as those with HIV infection, toxoplasmosis may cause devastating complications:
  - Encephalitis
  - Meningoencephalitis
  - Intracerebral abscess
  - Pneumonitis
  - Myocarditis
  - Generalized lymphadenopathy
CONGENITAL INFECTION

- The greatest risk of fetal injury occurs when the mother is infected in the first trimester of pregnancy.
- The manifestations of congenital toxoplasmosis include:
  - Disseminated purpuric rash
  - Hepatosplenomegaly
  - Ascites
  - Chorioretinitis
  - Uveitis
  - Periventricular calcifications
  - Ventriculomegaly
  - Seizures
  - Cognitive deficits

DIAGNOSIS

- Maternal
  - IgM antibody
  - Low avidity – IgG antibody
  - PCR
- Fetal
  - Detection of toxoplastic DNA in amniotic fluid
  - Identification of ultrasound abnormalities
    - Growth restriction
    - Ascites
    - Ventriculomegaly
    - Periventricular calcifications
    - Hepatosplenomegaly

MANAGEMENT DURING PREGNANCY

- Spiramycin – 1 gram orally three times daily for 3 weeks
- THEN oral pyrimethamine (50 mg daily) plus sulfadiazine (1 gram orally three times daily) for an additional 3 weeks
- Neonate should be treated for one year with the combination of pyrimethamine, sulfadiazine, and leucovorin
PREVENTION

- Pregnant women should be advised to minimize, or, ideally, avoid, contact with cat urine and feces. If they must change the litter box, they should wear gloves and change the litter daily.
- They should also be advised to take their beef or pork “well done” or “medium well.” The juices of the meat should be clear, not bloody.

REFERENCE


November 2021
TRIAL OF LABOR AFTER CESAREAN (TOLAC)

Erica Smith, M.D.

EPIDEMIOLOGY

Trial of labor after cesarean delivery (TOLAC) refers to the plan for attempted vaginal birth after cesarean (VBAC). Since the 1970's, the rate of cesarean delivery in the United States has increased six-fold. TOLAC is thought to be a safe practice for most women with a prior cesarean. The overall rate of successful TOLAC is 60 to 80% in carefully selected patients. However, as noted below, certain risk factors decrease the likelihood of success and increase the probability of maternal morbidity.

BENEFITS OF SUCCESSFUL TOLAC COMPARED TO ELECTIVE REPEAT CESAREAN

- Avoidance of major abdominal surgery
- Decreased rate of hemorrhage
- Decreased rate of thromboembolism
- Decreased rate of infection
- Shorter recovery period
- Avoidance of subsequent risks associated with multiple repeat cesarean deliveries
  - Bladder injury
  - Bowel injury
  - Blood transfusion
  - Abnormal placentation – necessitating cesarean hysterectomy

RISKS OF TOLAC COMPARED TO ELECTIVE REPEAT CESAREAN

- Increased rate of infection if TOLAC is unsuccessful
- Increased risk of uterine scar disruption (dehiscence or rupture)
- Increased risk of neonatal hypoxic ischemic encephalopathy (HIE) in the event of uterine scar disruption
FACTORS THAT INCREASE THE PROBABILITY OF SUCCESSFUL TOLAC

- Single low-transverse incision
- No recurring indication for cesarean
- Prior cesarean for a reason other than labor abnormality
- Spontaneous, as opposed to induced, labor
- Normal BMI
- Prior vaginal delivery, especially after the prior cesarean
- No evidence of fetal macrosomia
- No co-morbidity such as chronic hypertension, pre-eclampsia, or diabetes
- Maternal age < 35 years
- NIH VBAC calculator may be used to calculate relatively precise probability of successful TOLAC

CONTRAINDICATIONS TO TOLAC

- More than two prior low transverse incisions
- Prior classical incision
- Prior low vertical incision that extended into the upper contractile portion of the uterus
- Prior T-shaped incision that extended into the upper contractile portion of the uterus
- Previous myomectomy that extended into the endometrial cavity
- Previous uterine scar disruption, either dehiscence or overt rupture
- Medical or obstetric complications that preclude vaginal delivery

MANAGEMENT OF LABOR

- Avoid use of prostaglandins to "ripen" the cervix.
- Avoid induction in the face of an "unfavorable" cervix (defined as a Bishop Score < 6).
- Continuously monitor the patient throughout labor, ideally with a scalp electrode and intrauterine pressure catheter.
• Be constantly vigilant for evidence of uterine scar disruption. Possible manifestations include:
  o Abdominopelvic pain – may not be evident if the patient has epidural anesthesia
  o Abrupt loss of uterine pressure, if the intrauterine pressure catheter is in place
  o Fetal heart rate abnormalities
    ▪ Variable decelerations
    ▪ Late decelerations
    ▪ Tachycardia
    ▪ Bradycardia
  o Maternal tachycardia
  o Maternal hemorrhage

PROBABILITY OF UTERINE SCAR DISRUPTION

<table>
<thead>
<tr>
<th>CLINICAL SCENARIO</th>
<th>RISK OF SCAR DISRUPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>One prior low transverse incision</td>
<td>0.5 to 0.9%</td>
</tr>
<tr>
<td>Two prior low transverse incisions</td>
<td>0.9 to 1.8%</td>
</tr>
<tr>
<td>Classical or T-incision</td>
<td>4.0 to 9.0%*</td>
</tr>
<tr>
<td>Low vertical incision</td>
<td>2.0 to 7.0%*</td>
</tr>
<tr>
<td>Induction/augmentation of labor with oxytocin – one prior low transverse incision</td>
<td>0.8 to 1.1%</td>
</tr>
<tr>
<td>Induction/augmentation of labor with prostaglandin – one prior low transverse incision</td>
<td>1.4 to 2.2%</td>
</tr>
<tr>
<td>Prior uterine scar disruption – dehiscence or rupture</td>
<td>6 to 32%</td>
</tr>
</tbody>
</table>

*Disruption of a vertical incision usually is a true rupture, involving all three layers of the uterus.

REFERENCE

November 202
MFM GUIDELINES
SCREENING FOR TUBERCULOSIS IN PREGNANCY

- Routine screening of all pregnant patients is not indicated.
- Selective screening of the following patients should be performed at the time of the first encounter in the prenatal clinic.
  - Immigrants from Southeast Asia, Central America, South America, Mexico, the Caribbean islands, and other areas of the world where TB may be endemic (Africa, Asia, Eastern Europe, and Russia)
  - Migrant farm workers
  - Homeless persons or persons who work in homeless shelters
  - Prisoners or persons who work in jails and prisons
  - Persons who use illegal drugs
  - Residents and staff of chronic care facilities, such as mental health institutions and nursing homes
  - HIV-infected patients
  - Patients with chronic pulmonary disease such as cystic fibrosis
  - Severely immunocompromised patients, especially those with malignancies
  - Patients with chronic renal disease, particularly those on dialysis
  - Close contacts, particularly household contacts, of persons with known TB
  - HCWs with occupational exposure to patients with known TB
  - Persons who have unexplained weight loss, fever, night sweats, prolonged cough, or hemoptysis
  - Patients who specifically request testing or who the provider considers to be at high risk
- The preferred screening test is the Quantiferon-TB Gold Plus. The lab number is Lab123000150.
- If the Quantiferon-TB Gold Plus test is positive, the patient should have a p-a and lateral chest x-ray.
- If the chest-x-ray shows no evidence of active TB, please consult with a member of the MFM Division to determine if prophylaxis is indicated during, or immediately after, pregnancy.

Please note: These recommendations are based upon those presented by the CDC and the USPSTF.

MFM Division 3/16/2021
ROUTINE ULTRASOUNDS IN PREGNANCY  
TIMING AND CONTENT  

Reem S. Abu-Rustum, M.D.

TYPES OF SCANS

There are various types of scans based on the gestational age and the indications for imaging:
- Standard First Trimester Ultrasound Examination
- Detailed First Trimester Ultrasound Examination
- Standard Second and Third Trimester Ultrasound Examination
- Detailed Second and Third Trimester Ultrasound Examination
- Limited Obstetric Ultrasound Examination
- Specialized Ultrasound Examinations

DESCRIPTION OF ULTRASOUND EXAMINATION

<table>
<thead>
<tr>
<th>Examination</th>
<th>Description of Examination (Reference 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard First Trimester Ultrasound Examination</td>
<td>A standard obstetrical ultrasound examination in the first trimester includes evaluation of the presence, size, location, and number of gestational sac(s), ascertaining fetal viability and evaluating the uterus, cervix, adnexa, and cul-de-sac region.</td>
</tr>
<tr>
<td>Detailed First Trimester Ultrasound Examination</td>
<td>The components of this examination promote a systematic method of assessing fetal anatomy that optimizes the early detection of anomalies.</td>
</tr>
<tr>
<td>Standard Second and Third Trimester Ultrasound Examination</td>
<td>This examination includes an evaluation of fetal number, cardiac activity, presentation, amniotic fluid volume, placental position, fetal biometry, and an anatomic survey. The maternal cervix and adnexa are also examined.</td>
</tr>
<tr>
<td>Detailed Second and Third Trimester Ultrasound Examination</td>
<td>This examination is more comprehensive than the standard examination. It is indication-driven as highlighted below in the section on indications.</td>
</tr>
</tbody>
</table>
| Limited Obstetric Ultrasound Examination        | This examination is performed to answer a specific, acute clinical question when an immediate impact on management is anticipated and when time or other constraints make performance of a standard ultrasound impractical or unnecessary.  
If a limited obstetric ultrasound is performed on a woman who has not previously had a standard or detailed ultrasound examination, a subsequent standard or detailed ultrasound should be obtained, where appropriate.  
In patients who require serial ultrasounds and have already had a standard or detailed scan, some will only need limited scans, whereas others will require standard or detailed follow-up examinations. Clinical judgement should be used to determine the proper type of ultrasound examination to perform and the appropriate frequency for follow-up ultrasound examinations |
| Specialized Ultrasound Examinations             | These include fetal echocardiogram, biophysical profile and fetal Doppler ultrasound, or additional biometric measurements including nuchal translucency (NT) and cervical length, as indicated. |
### Indications and Timing for the Examination

#### Standard First Trimester Ultrasound Examination (References 1-3)
**Performed Prior to 14 weeks**
1. Confirmation of the presence of an intrauterine pregnancy
2. Confirmation of cardiac activity
3. Estimation of gestational age
4. Diagnosis or evaluation of multiple gestations including determination of chorionicity
5. Evaluation of a suspected ectopic pregnancy
6. Evaluation of the cause of vaginal bleeding
7. Evaluation of pelvic pain
8. Evaluation of suspected gestational trophoblastic disease
9. Assessment for certain fetal anomalies, such as anencephaly
10. Measurement of the NT when part of a screening program for fetal aneuploidy
11. Imaging as an adjunct to chorionic villus sampling, embryo transfer, and localization and removal of an intrauterine device
12. Evaluation of maternal pelvic masses and/or uterine abnormalities

#### Detailed First Trimester Ultrasound Examination (Reference 4)
**Performed at 12 to 13 weeks 6 days**
1. Previous fetus or child with a congenital, genetic, or chromosomal anomaly
2. Known or suspected fetal abnormality detected by ultrasound in the current pregnancy.
3. Fetus at increased risk for a congenital anomaly based on the following:
   a. 35 years or older at delivery
   b. Maternal pregestational diabetes
   c. Pregnancy conceived via in vitro fertilization
   d. Multiple gestation
   e. Teratogen exposure
   f. Enlarged nuchal translucency
   g. Positive screening test results for aneuploidy, including cell-free DNA screening and serum only or combined first-trimester screening
4. Other conditions possibly affecting the pregnancy/ fetus, including:
   a. Maternal body mass index of 30 kg/m² or higher
   b. Placental implantation covering the internal cervical os or under a cesarean scar site or cesarean scar pregnancy diagnosed in index gestation.

#### Standard Second and Third Trimester Ultrasound Examination (References 1-3)
**Performed After 18 Weeks (Preferably after 20 weeks)**
1. Screening for fetal anomalies
2. Evaluation of fetal anatomy
3. Estimation of gestational age
4. Evaluation of suspected multiple gestation
5. Evaluation of cervical length
6. Evaluation of fetal growth
7. Evaluation of significant discrepancy between uterine size and clinical dates
8. Determination of fetal presentation
9. Evaluation of fetal well-being
10. Suspected amniotic fluid abnormalities
11. Evaluation of premature rupture of membranes and/or premature labor
12. Evaluation of vaginal bleeding
13. Evaluation of abdominal or pelvic pain
14. Suspected placental abruption
15. Suspected fetal death
16. Evaluation of abnormal biochemical markers
17. Follow-up evaluation of a fetal anomaly
18. History of a previous congenital anomaly
19. Evaluation/follow-up of placental appearance and location. Includes suspected placenta previa, vasa previa, and abnormally adherent placenta
20. Adjunct to amniocentesis or other procedure
21. Adjunct to external cephalic version
22. Evaluation of suspected gestational trophoblastic disease
23. Evaluation of pelvic mass
24. Suspected uterine anomalies

**Detailed Second and Third Trimester Ultrasound Examination (References 5-6) Performed After 18 Weeks (Preferably after 20 weeks)**

1. Previous fetus or child with a congenital, genetic, or chromosomal abnormality
2. Known or suspected fetal anomaly or known or suspected fetal growth restriction in the current pregnancy
3. Fetus at increased risk for a congenital anomaly as a result of:
   a. Maternal pregestational diabetes or gestational diabetes diagnosed before 24 weeks’ gestation
   b. Pregnancy conceived via assisted reproductive technology
   c. Maternal body mass index of 30 kg/m² or higher
   d. Multiple gestations
   e. Abnormal maternal serum analytes
   f. Teratogen exposure
   g. First-trimester nuchal translucency measurement of 3.0 mm or greater
4. Fetus at increased risk for a genetic or chromosomal abnormality as a result of:
   a. Parental carrier of a chromosomal or genetic abnormality
   b. Maternal age of 35 years or older at delivery
   c. Positive screening test results for aneuploidy
   d. Aneuploidy marker noted on an ultrasound examination
   e. First-trimester nuchal translucency measurement of 3.0 mm or greater
5. Other conditions affecting the fetus, including:
   a. Congenital infections
   b. Maternal drug use
   c. Autoimmunization
   d. Oligohydramnios
   e. Polyhydramnios
6. Suspected placenta PAS or risk factors for PAS such as placenta previa in the third trimester or a placenta overlying a prior cesarean scar site.

**Limited Obstetric Ultrasound Examination (Reference 7) Performed as indicated throughout gestation**

First trimester indications include but are not limited to:
   a. Confirmation of the presence of an intrauterine pregnancy
   b. Confirmation of cardiac activity
   c. Estimation of gestational age
   d. Adjunct ultrasound guidance for chorionic villus sampling, embryo transfer, and localization and removal of an intrauterine contraceptive device.

Second or third trimester indications include but are not limited to:
   a. Confirmation of cardiac activity
   b. Estimation of gestational age
   c. Determination of fetal presentation
   d. Evaluation of amniotic fluid volume
   e. Evaluation of fetal growth, size/date discrepancy
   f. Evaluation of fetal well-being
   g. Evaluation of placental location, including relationship with the internal cervical os;
h. Adjunct ultrasound guidance for amniocentesis, external cephalic version, or other procedure
i. Cervical length assessment (requires additional specialized education, training, and credentialing)

REFERENCES
URINARY TRACT INFECTIONS IN PREGNANCY

Patrick Duff, M.D.

Epidemiology

<table>
<thead>
<tr>
<th>Type of Infection</th>
<th>Frequency in Pregnancy</th>
<th>Principal Microorganisms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute urethritis</td>
<td>3 to 5%</td>
<td>Chlamydia – 2 to 3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gonorrhea – 1 to 2%</td>
</tr>
<tr>
<td>Asymptomatic bacteriuria</td>
<td>5 to 8%</td>
<td>E. coli – predominant organism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Klebsiella pneumoniae</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Proteus species</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Enterococci</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Group B streptococci</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Staphylococcus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>saprophyticus</td>
</tr>
<tr>
<td>Acute cystitis</td>
<td>2 to 3%</td>
<td>Same</td>
</tr>
<tr>
<td>Acute pyelonephritis</td>
<td>1 to 2%</td>
<td>Same</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Gram-positive organisms are less likely to cause pyelonephritis</td>
</tr>
</tbody>
</table>

Clinical Manifestations

<table>
<thead>
<tr>
<th>Infection</th>
<th>Usual Clinical Manifestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute urethritis</td>
<td>Frequency, dysuria, purulent urethral discharge</td>
</tr>
<tr>
<td>Asymptomatic bacteriuria</td>
<td>None</td>
</tr>
<tr>
<td>Acute cystitis</td>
<td>Frequency, dysuria, hesitancy, suprapubic discomfort, low-grade fever</td>
</tr>
<tr>
<td>Acute pyelonephritis</td>
<td>Lower tract symptoms plus fever, shaking chills, flank pain and tenderness</td>
</tr>
<tr>
<td></td>
<td>May cause preterm labor, sepsis, ARDS</td>
</tr>
</tbody>
</table>

Diagnosis

- Urinanalysis
  - Positive leukocyte esterase
  - Positive nitrite
Elevated urine pH (8 or greater) suggests *Proteus* infection

- **Urine culture**
  - If urine is obtained by mid-stream, clean-catch technique, the threshold for defining a positive culture is > 100,000 colonies/ml
  - If urine is obtained by catheterization, the threshold is > 100 colonies/ml
  - Catheterization is the preferred technique to avoid contamination of the specimen by vaginal organisms. A clean-catch specimen is very difficult to obtain in pregnancy, especially in an obese patient.

**TREATMENT**

<table>
<thead>
<tr>
<th>Infection</th>
<th>Antibiotic Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute urethritis</td>
<td>Chlamydia – azithromycin, 1000 mg orally in a single dose</td>
</tr>
<tr>
<td></td>
<td>Gonorrhea – ceftriaxone, 500 mg i.m. in a single dose OR cefixime, 800 mg orally in a single dose *</td>
</tr>
<tr>
<td>Asymptomatic bacteriuria or acute cystitis</td>
<td>First trimester – amoxicillin, 875 mg twice daily or 500 mg three times daily for 7 days OR cephalexin, 500 mg three times daily for 7 days</td>
</tr>
<tr>
<td></td>
<td>Second and third trimester – nitrofurantoin macrocrystals (Macrobid), 100 mg orally twice daily for 7 days OR trimethoprim-sulfamethoxazole double strength twice daily for 7 days</td>
</tr>
<tr>
<td>Acute pyelonephritis</td>
<td>First half of pregnancy if patient is hemodynamically stable – amoxicillin-clavulanate 875 mg twice daily for 10 days OR trimethoprim-sulfamethoxazole double strength twice daily for 10 days (do not use in first trimester)</td>
</tr>
<tr>
<td></td>
<td>Second half of pregnancy – ceftriaxone, 2 grams i.v. every 24 hours until patient is afebrile and asymptomatic, then amoxicillin-clavulanate or trimethoprim-sulfamethoxazole in the doses listed above to complete a 10-day course</td>
</tr>
</tbody>
</table>

*If penicillin allergic: gentamicin, 240 mg i.m. in a single dose PLUS azithromycin, 2000 mg orally in a single dose*
PREVENTION

- After a single episode of pyelonephritis, administer prophylaxis for the remainder of pregnancy
- After two or more episodes of lower tract infection, administer prophylaxis for the remainder of pregnancy
- Preferred agent for prophylaxis is nitrofurantoin macrocrystals (Macrobid), 100 mg orally at bedtime


October 2021
VACCINATIONS DURING PREGNANCY

Patrick Duff, M.D.

The following vaccinations are indicated in all, or in selected, obstetric patients. They are either inactivated vaccines or vaccines that do not contain infectious viral particles (e.g., mRNA or DNA or toxoids).

<table>
<thead>
<tr>
<th>VACCINE</th>
<th>TARGET POPULATION</th>
<th>TIMING OF VACCINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>COVID-19*</td>
<td>All pregnant and postpartum patients</td>
<td>Any time in pregnancy or the postpartum period</td>
</tr>
<tr>
<td>Hepatitis A</td>
<td>High risk patients: international travelers, IV drug users, occupational exposure, residents and staff of chronic care facilities, chronic liver disease, residents in endemic areas</td>
<td>Any time in pregnancy or the postpartum period</td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>Any pregnant or postpartum patient who was not previously vaccinated</td>
<td>Any time in pregnancy or the postpartum period</td>
</tr>
<tr>
<td>Influenza A/B</td>
<td>All pregnant or postpartum patients</td>
<td>August – March of each year</td>
</tr>
<tr>
<td>Pneumococcal Vaccine**</td>
<td>High risk patients: patients who have had a splenectomy, patients who have sickle cell anemia, patients with chronic cardiopulmonary, hepatic, or renal disease, patients with immunosuppressive conditions such as HIV infection, patients with a cochlear implant, patients with chronic CSF leakage</td>
<td>Any time in pregnancy or the postpartum period</td>
</tr>
<tr>
<td>Tdap</td>
<td>All pregnant or postpartum patients</td>
<td>Ideally, given at beginning of third trimester</td>
</tr>
</tbody>
</table>

*Johnson & Johnson – one dose plus booster of any of the 3 vaccines after 2 months
Modern – two doses separated by 4 weeks plus booster after 6 months
Pfizer – two doses separated by 3 weeks plus booster after 5 months

**Immunosuppressed patients should receive a third dose of the Pfizer or Moderna vaccine 28 days after the second dose. They then should receive the booster in 5 months (Pfizer) or 6 months (Moderna).**

**PPSV23 (Pneumovax) initially, then PCV13 (Prevnar) in one year

REFERENCE

Duff P. Vaccinations for the ObGyn’s toolbox. OBG Management, Volume 33, October 2021.
**MANAGEMENT OF VAGINITIS IN PREGNANCY**
Patrick Duff, M.D.

<table>
<thead>
<tr>
<th>INFECTION</th>
<th>PRINCIPAL MICROORGANISMS</th>
<th>CLINICAL MANIFESTATIONS</th>
<th>DIAGNOSIS *</th>
<th>PERINATAL COMPLICATIONS</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moniliasis</td>
<td><em>C. albicans</em></td>
<td>White, curd-like discharge that adheres to vaginal mucosa Vulvar erythema Punctate erythematosus lesions in crural folds</td>
<td>Vaginal pH normal (3.8-4.2) KOH microscopy → budding yeast and hyphae Culture – only indicated in cases of refractory infection</td>
<td>Rare</td>
<td>Topical Clotrimazole x 3 d Miconazole x 3 -7 d, depending upon formulation Terconazole x 3 d Oral Fluconazole – 150 mg on day 1 and 3</td>
</tr>
<tr>
<td></td>
<td><em>C. tropicalis</em></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td><em>C. glabrata</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trichomoniasis</td>
<td><em>Trichomonas vaginalis</em></td>
<td>Yellow-green frothy discharge Punctate lesions on cervix (“strawberry cervix”)</td>
<td>Vaginal pH 4.5 or greater Saline microscopy-motile trichomonads</td>
<td>Rare</td>
<td>Metronidazole, 500 mg orally twice daily x 7 d OR 2 grams in a single dose (slightly less effective)</td>
</tr>
<tr>
<td>Bacterial vaginosis</td>
<td><em>Genital mycoplasmas</em></td>
<td>Thin white-gray discharge with fish-like odor</td>
<td>Vaginal pH 4.5 or greater Positive amine test Saline microscopy → decreased lactobacilli and many small cocci and bacilli</td>
<td>Preterm labor Preterm PROM Chorioamnionitis Post-cesarean endometritis</td>
<td>Metronidazole, 500 mg orally twice daily x 7 d ** Clindamycin, 300 mg orally twice daily x 7 d **</td>
</tr>
<tr>
<td></td>
<td><em>Gardnerella vaginalis</em></td>
<td></td>
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</tr>
<tr>
<td></td>
<td><em>Anaerobes</em></td>
<td></td>
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</tr>
</tbody>
</table>

* Several rapid point of care tests are now available that test simultaneously for several vaginal infections. They have varying sensitivities when compared to the standard tests outlined in the table.

** Topical metronidazole and clindamycin can treat the localized BV, but these drugs will not prevent the systemic complications such as preterm labor, chorioamnionitis, and endometritis
VARICELLA IN PREGNANCY

Patrick Duff, M.D.

EPIDEMIOLOGY

Varicella-zoster is a DNA virus that is a member of the herpesvirus family. The organism causes varicella (chickenpox) and herpes zoster infection (shingles). Varicella typically causes a mild infection in children. The infection is rare in adults, including pregnant women, but when it occurs, it can cause two life-threatening complications: pneumonia (20% of cases) and encephalitis (1% of cases). The organism is spread by respiratory droplets and by close personal contact, and it is one of the most contagious of all the viral pathogens. The incubation period of the organism is 10 to 14 days.

CLINICAL MANIFESTATIONS

The key feature of varicella is a disseminated, intensely pruritic, vesicular rash. The lesions typically occur in crops and evolve in sequential fashion from papule to clear vesicle to pustule to a dry, crusted scab. They begin on the trunk and spread centripetally to the extremities. The pulmonary infection that complicates some cases of varicella is often accompanied by a secondary bacterial infection. Congenital infection is rare, affecting fewer than 1% of fetuses when maternal infection occurs in weeks 1-12 and fewer than 2% of fetuses when maternal infection occurs in weeks 13 – 20.

DIAGNOSIS OF MATERNAL INFECTION

- Clinical examination
- Viral serology – positive IgM-specific antibody
- Viral culture
- PCR
DIAGNOSIS OF FETAL INFECTION – KEY ULTRASOUND FINDINGS

- Fetal growth restriction
- Microcephaly
- Ventriculomegaly
- Echogenic foci in the liver
- Limb abnormalities

NEONATAL VARICELLA

- Neonatal infection occurs when maternal infection develops in the period from 5 days before delivery to 2 days after delivery
- Manifestations of neonatal infection
  - Disseminated mucocutaneous lesions
  - Visceral infection
  - Pneumonia
  - Encephalitis

PREVENTION OF VARICELLA

- At the first prenatal appointment, patients should be queried about a prior natural history of varicella or varicella vaccination. If a clear history cannot be documented, a varicella-zoster IgG antibody test should be ordered. Approximately 75% of patients with an indeterminate history are, in fact, immune.
- Susceptible patients should be advised to avoid contact with other individuals who may be infected.
- Susceptible patients should be vaccinated postpartum with the live virus vaccine (Varivax), which is administered in two subcutaneous doses, 4 to 6 weeks apart.
- If a susceptible patient is exposed to an individual with well-documented varicella, she should receive one of three treatments within 72 – 96 hours of exposure:
  - Varicella-zoster immune globulin (VariZIG), 125 units/10 kg (maximum of 5 vials). The U.S. distributor
of this agent is FFF Enterprises in Temecula, California. The company should be contacted by telephone (800 843 7477). If company representatives confirm that the patient is eligible, the drug will be delivered within 24 hours.

- Oral acyclovir, 800 mg five times daily for 7 days
- Oral valacyclovir, 1000 mg three times daily for 7 days

- Preventive measures for neonatal varicella
- Isolate infant from mother until her lesions have dried and crusted over
- Administer VariZIG or antiviral medication to the infant

**TREATMENT OF VARICELLA**

- The pregnant woman with mild disease should be treated with oral acyclovir (800 mg five times daily for 7 days) or oral valacyclovir (1000 mg three times daily for 7 days).
- The seriously ill patient should be hospitalized and treated with intravenous acyclovir (10 mg/kg infused over 1 hour every 8 hours for 10 days)
- Secondary bacterial pneumonia should be treated with appropriate antibiotics such as ceftriaxone and azithromycin.

**VARICELLA-ZOSTER INFECTION**

- Varicella-zoster (shingles) poses no risk to the fetus because the mother has antibodies to the virus, which cross the placenta and protect the fetus.
- Because the condition is so painful, however, the mother should be treated with antiviral agents in the doses outlined above.

**REFERENCE**


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