Learning Objectives

1. Identify appropriate techniques to recognize and manage premature onset of labor.
3. Describe management of induction and augmentation of labor including postterm pregnancy.
4. Recall the recognition and treatment of late pregnancy bleeding including abruptio placentae, placenta previa, and postpartum hemorrhage.

Hypertension

- Most common medical disorder during pregnancy
  - 6-8% of pregnancies
  - Second leading cause of maternal mortality in the US — accounts for 15% of such deaths
- Gestational BP elevation - at least two determinations
  - 140 mm Hg systolic or higher or
  - 90 mm Hg diastolic or higher
- Classifying disease
  - Antedates the pregnancy (< 20 weeks): chronic hypertension
  - Ominous disease peculiar to pregnancy (>20 weeks): preeclampsia
- Nomenclature
  - Preeclampsia-eclampsia
  - Chronic hypertension
  - Preeclampsia superimposed upon chronic hypertension
  - Gestational hypertension

Preeclampsia-Eclampsia

- Diagnosis
  - Gestational BP elevation after 20 weeks of gestation in a woman with previously normal BP
  - Proteinuria ≥ 0.3 g protein in a 24-hour urine specimen
  - In the absence of proteinuria, increased BP accompanied by
    - Symptoms of headache, blurred vision, abdominal pain
    - Abnormal laboratory tests
      - Low platelet counts
      - Abnormal liver enzymes
- Patients who have had preeclampsia have a 4X increased risk of hypertension and a 2X increased risk of ischemic heart disease, stroke, and VE.
  - No association between preeclampsia and cancer

1. A 20-year-old female is seen for follow-up 6 weeks after delivery. Her pregnancy was complicated by preeclampsia. Her examination is unremarkable. This patient will be at increased risk for which of the following in mid-life?

A. Breast Cancer  
B. Diabetes mellitus  
C. Hypothyroidism  
D. Ischemic heart disease

77%  
1%  
16%  
6%

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Risk Factors for Preeclampsia

- **Pregnancy-associated factors**
  - Chromosomal abnormalities
  - Hydatidiform mole
  - Hydrops fetalis
  - Multifetal pregnancy
  - Oocyte donation or donor insemination
  - Structural congenital abnormalities
  - Urinary tract infection

- **Paternal-specific factors**
  - First-time father
  - Previously fathered a preeclamptic pregnancy in another woman

- **Maternal-specific factors**
  - Age <20 and >35
  - Black race
  - Family history
  - Nulliparity
  - Preeclampsia in previous pregnancy
  - Medical conditions
    - DM
    - Type 1 DM
    - Obesity
    - Chronic hypertension
    - Renal disease
    - Thrombophilias

Chronic Hypertension

- Gestational BP elevation before the 20th week of gestation
- Hypertension that is diagnosed for the first time during pregnancy and does not resolve postpartum is also classified as chronic hypertension
- **Chronic hypertension is the most common cause of IUGR**

Gestational Hypertension

- Gestational blood pressure elevation without proteinuria that is detected for the first time after 20 weeks gestation
- Two types
  - *Transient hypertension of pregnancy* - preeclampsia has not developed and BP has returned to normal by 12 weeks postpartum
  - *Chronic hypertension* - BP elevation persists

Prevention

- Low Dose ASA
  - Women without risk factors – No benefit
  - At risk, 19% reduction, NNT = 69
- Calcium Supplementation
  - No data that dietary supplementation with calcium will prevent preeclampsia in low-risk women in the US.
  - Helpful
    - High risk of gestational hypertension (teenagers, previous preeclampsia, women with increased sensitivity to angiotensin II, preexisting hypertension)
    - Communities with low dietary calcium intake (mean intake < 900 mg/d) demonstrate significant reductions in incidence of preeclampsia.

2. 19-yo primigravida at approximately 40 weeks EGA comes to the hospital with painful contractions. She has received no prenatal care. Examination: Cervix is 4 cm dilated and 80% effaced at station -1. Blood pressure is 164/111 mm Hg and a urine dipstick shows 3+ protein. She reports that she has had severe headaches for 3 days and has noticed a lot of swelling in her hands and feet. Moments after her blood is drawn and IV access is obtained, she has a generalized tonic-clonic seizure and fetal heart tones drop to 60 BPM.

Which of the following is the most appropriate immediate course of action?

- A. Emergency cesarean section
- B. Lorazepam (Ativan), 2 mg IV push, repeated in 2 minutes if necessary
- C. Magnesium sulfate, 4 g loading dose IV, followed by a drip at 2 g/hr
- D. Terbutaline, 0.25 mg subcutaneously
Management

- Anticonvulsant Therapy
  - MgSO4
  - Reduces the risk of first or subsequent seizures in women with severe preeclampsia
  - Reduces risk of subsequent seizures in women with eclampsia
    - Antidote for toxicity: Calcium gluconate 1 g IV over 3 minutes
- Antihypertensive Therapy
- Vaginal delivery is preferred!

Antihypertensive Therapy

### Acute Hypertension

- BP dangerously high or rises suddenly in women with preeclampsia, especially intrapartum
- Treat persistent DBP > 105-110

<table>
<thead>
<tr>
<th>Pharmacologic Agent</th>
<th>Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methylnoradrenaline and norepinephrine</td>
<td>8 mg IV over 1-2 minutes, or IM</td>
</tr>
<tr>
<td>Beta-blocker</td>
<td>20-40 mg IV bolus or 1 mg/kg infusion (Maximum 220 mg)</td>
</tr>
<tr>
<td>Calcium antagonists</td>
<td>10 mg po and repeat in 30 minutes, if necessary</td>
</tr>
<tr>
<td>Sodium nitroprusside</td>
<td>0.25 mcg/kg/min to a maximum of 5 mcg/kg/min</td>
</tr>
</tbody>
</table>

### Chronic Hypertension in Pregnancy

- Seely, Ellen; Ecker, Jeffrey

Postpartum Management

- Oral agents may be needed after delivery
  - Prepregnancy BP normal or unknown — stop oral medication after 3-4 weeks, observe BP q 1-2 weeks for 1 month; then q 3-6 m for one year
    - If hypertension recurs — treat — most likely chronic
- Greatest risk for postpartum hypertension
  - Antenatal preeclampsia — particularly with higher urinary protein, serum uric acid, and BUN

Gestational diabetes has been associated with all of the following perinatal complications **EXCEPT:**

A. Increased frequency of maternal hypertensive disorders
B. Increased risk of operative delivery
C. Increased frequency of neonatal hyperglycemia
D. Increased risk of intrauterine fetal death during last 4-8 weeks of gestation
3. Gestational diabetes has been associated with all of the following perinatal complications EXCEPT:

A. Increased frequency of maternal hypertensive disorders
B. Increased risk of operative delivery
C. Increased frequency of neonatal hyperglycemia
D. Increased risk of intrauterine fetal death during last 4-8 weeks of gestation

Why all the Fuss….

Adverse Outcomes

Maternal
- Increased frequency of maternal hypertensive disorders
  - Cesarean delivery
- Increase risk of intrauterine fetal death during last 4-8 weeks of gestation.
  - Fasting hyperglycemia (>105 mg/dL)

Fetal
- Excessive fetal growth (macrosomia)
- Increased risk for operative delivery
- Shoulder dystocia
- Birth trauma
- Neonatal morbidity
- Hypoglycemia
- Hypocalcemia
- Hyperbilirubinemia
- Polyhydramnios

The most common cause of neonatal death in children of mothers known to have DM before pregnancy is congenital anomalies.

4. 26-year-old G1 P0 at 28 weeks gestation has a 1-hour plasma glucose level of 145 mg/dL on a 50 g/hr glucose challenge test. A 3-hour glucose tolerance test confirms gestational diabetes. You initially recommend glucose monitoring and treatment with diet and physical activity. You would recommend insulin therapy if her 2-hour postprandial blood glucose levels are not consistently below which of the following target levels?

A. 100 mg/dL
B. 120 mg/dL
C. 140 mg/dL
D. 160 mg/dL

Gestational Diabetes Mellitus

Maternal Surveillance– Glucose Monitoring

- Optimal frequency in GDM not established
  - Fasting whole blood glucose ≤ 95 mg/dL (< 105 plasma)
  - 2 hour postprandial ≤ 120 mg/dL (< 130 plasma)
  - 1-2 times per week versus daily
- Human Insulin therapy - (if on more than three occasions) (Level B)
  - > 95 mg/dL fasting whole blood glucose or
  - > 120 mg/dL 2-h postprandial
  - Daily glucose monitoring

Oral Hypoglycemic Agents and Pregnancy

- Not well-studied
- Glyburide – does not cross placenta – and has been used to treat GDM
- Metformin (Category B)
  - Many reports of use in pregnancy
  - Long-term effects of in-utero exposure not well-studied
- Use of oral agents for control of type 2 DM during pregnancy should be limited and individualized until data regarding safety and efficacy becomes available

Pregestational DM. ACOG Practice Bulletin No. 61, March 2005
Diabetes Mellitus

**Timing of Delivery??**

- **A1** - Manage expectantly
  - as long as glucose values normal
- **A2/B** - Deliver by 40 weeks
  - close (twice weekly) monitoring if beyond 38 weeks
  - any intervention, document FLM?
- Poor control/Complications
  - document lung maturity
  - deliver at 38 weeks/maturity (induction)

ACOG – 2001, Reaffirmed 2008

**Long-Term Considerations**

- Increased risk for recurrence of GDM
  - 33-50% likelihood
- Increased risk for development of DM after pregnancy
  - 35% of women 5-10 years after parturition
  - Usually type 2
- Offspring – Increased risk
  - Obesity
  - Glucose intolerance
  - Diabetes in late adolescence and young adulthood

5. A 26-year-old G2P1 presents at 30 weeks gestation with a complaint of severe itching. She has excoriations from scratching in various areas. She says that she had the same problem during the last pregnancy, and her medical records reveal a diagnosis of intrahepatic cholestasis of pregnancy. **Elevation of which of the following is most characteristic of this disorder?**

A. GGT  
B. Bile acids  
C. Direct bilirubin  
D. Prothrombin time

5. A 26-year-old G2P1 presents at 30 weeks gestation with a complaint of severe itching. She has excoriations from scratching in various areas. She says that she had the same problem during the last pregnancy, and her medical records reveal a diagnosis of intrahepatic cholestasis of pregnancy. **Elevation of which of the following is most characteristic of this disorder?**

- **A. GGT**  
- **B. Bile acids**  
- **C. Direct bilirubin**  
- **D. Prothrombin time**

**Intrahepatic Cholestasis of Pregnancy (ICP)**

- Most common pregnancy-related liver disorder
- **Etiology – Ambiguous**
  - Abnormalities in the metabolism and disposition of sex hormones and/or bile acids
  - ? Genetic predisposition
  - ? Environmental factors

**Intrahepatic Cholestasis of Pregnancy - Diagnosis**

- **Historic**
  - Pruritus夜间, pruritus continually (with no rash) and mild jaundice during the 3rd trimester; elevation of serum level of total bile acids
  - Clinical jaundice in 50% of cases; pruritus worsens with onset of jaundice
  - Tends to recur (60-70%), severity varies
  - Seldom exhibits before 25 weeks
- **Hepatitis**
  - More than 20% of women known to be infected with hepatitis C develop ICP; so testing is indicated
- **Liver biopsy**
  - Pathologic findings are not specific, and a liver biopsy is rarely indicated

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Laboratory Presentation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum alkaline phosphatase</td>
<td>Increased 5-10 fold (hepatic &gt; placental)</td>
</tr>
<tr>
<td>Bilirubin</td>
<td>Elevated bilirubin (conjugated, &lt; 5mg/dL)</td>
</tr>
<tr>
<td>Serum transaminases</td>
<td>Usually normal</td>
</tr>
<tr>
<td>Serum bile acids (fasting)</td>
<td>&gt; 3 times upper limit of normal</td>
</tr>
<tr>
<td>GGT</td>
<td>Usually normal or modestly elevated – may help to differentiate this condition from other cholestatic liver diseases</td>
</tr>
<tr>
<td>PT</td>
<td>Usually normal – but if elevated may reflect a vitamin K deficiency from malabsorption</td>
</tr>
</tbody>
</table>

Pharmacologic Treatment

- Goal - decrease maternal symptomatology and enhance fetal outcome
- Main drug prescribed – most benefit for both mother and infant - Ursodeoxycholic acid*
  - 10 mg/kg q day


Pharmacologic Treatment

<table>
<thead>
<tr>
<th>Drug</th>
<th>Action</th>
<th>Effect</th>
<th>Pregnancy Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholestyramine</td>
<td>Anion exchange resin binding bile acids in the intestine for excretion</td>
<td>Decreased pruritus, no effect on fetal outcome; no effect on liver enzymes</td>
<td>C</td>
</tr>
<tr>
<td>Desmetomethexone</td>
<td>Suppression of fetal production of endogenous bile acid levels</td>
<td>Alleviate pruritus and liver enzyme abnormalities</td>
<td>C</td>
</tr>
<tr>
<td>Epomide</td>
<td>Triggers complex, prevents and reverses cholestasis induced by cholestasis</td>
<td>Alleviate pruritus; no change in liver enzyme abnormalities</td>
<td>C</td>
</tr>
<tr>
<td>Phenobarbital</td>
<td>Reduces hepatic enzymes to increase bile acids</td>
<td>Some benefit to decreased symptoms; no effect on fetal outcome</td>
<td>B</td>
</tr>
<tr>
<td>Ursodeoxycholic acid, Aragil, and broccoli</td>
<td>Hydrophilic bile acid that replaces more cytotoxic bile acids</td>
<td>Decrease pruritus, bile acids; improved fetal outcome</td>
<td>B</td>
</tr>
<tr>
<td>Hydroxycholic acid</td>
<td>Antithrombin activity</td>
<td>Decreased pruritus</td>
<td>C</td>
</tr>
</tbody>
</table>

Outcomes

**ICP**

- Maternal – usually benign
  - Impaired quality of life
  - Pruritus and abnormal laboratory tests resolve within 1-2 weeks of delivery, no sequelae

- Fetal – may be serious
  - Higher bile acid levels and impaired transport of bile acids from the fetus through the uteroplacental circulatory system
    - Preterm labor, preterm delivery
    - Fetal compromise
    - Increased risk of cesarean delivery
    - Meconium-stained amniotic fluid
    - IUFD

Bleeding in Late Pregnancy

- Placenta previa
- Placenta abruption
- Vasa previa
- Cervical trauma (e.g. intercourse)
- Vaginal Infections
- “Bloody Show”

6. Which of the following is NOT a risk factor for placenta previa?

A. Young maternal age
B. Prior cesarean delivery
C. Advanced maternal age
D. Tobacco
6. Which of the following is NOT a risk factor for placenta previa?

- 56% A. Young maternal age
- 40% B. Prior cesarean delivery
- 12% C. Advanced maternal age
- 12% D. Tobacco

**Placenta Previa**

- Occurs in 0.3-0.6% of all births
- Painless vaginal bleeding
- Bleeding patterns – First bleeding episode
  - Before 30 weeks: 33%
  - Between 30 and 35 weeks: 33%
  - After 36 weeks: 33%
- Each successive episode of bleeding may be heavier, more unpredictable

**Placenta Previa**

**Etiology**

- Usually none is found
- **Risks**
  - Prior C/S or history of uterine curettage
  - ? Damage to myometrium or endometrium
  - Cocaine
  - Advanced maternal age
  - Tobacco
- Recurrence rate of 6-12X in subsequent pregnancy
- Malpresentation is the result rather than the cause of previa

**Placenta Previa**

**Diagnosis**

- Antenatal by ultrasound
- Before 24 weeks, only a cautionary significance is attributed to a placenta close to the os
  - 90% have moved away from the os at term
  - Need to confirm “movement” in 3rd trimester
- In cases where the bulk of the placenta is over the os after 24 weeks, it is less likely to be clear of the os at term.

7. Placental abruption is associated with each of the following maternal conditions EXCEPT:

- 80% A. Trauma
- 2% B. Tobacco
- 12% C. Hypertensive Disorders
- 7% D. Diabetes

**Placental Abruption**

- 80% A. Trauma
- 2% B. Tobacco
- 12% C. Hypertensive Disorders
- 7% D. Diabetes
Placenta Abruption

- Separation of the placenta from implantation site
- Occurs in approximately 1% of all deliveries
  - Incidence increases with gestational age
  - Most serious complications are due to hypovolemia → Acute renal failure
- Etiology
  - Trauma, cocaine abuse, acute decompression of amniotic fluid, preterm rupture, hypertensive disorders, tobacco
- Risk of recurrence high (20-30x)

Management

- Assess fetal viability
  - Fetal demise – here placental detachment usually > 50%
  - Deliver the fetus
  - Prepare to transfuse
  - Live fetus + rigid uterus – again > 50% detachment
    - 90% fetal demise → C/S
  - Live fetus + soft uterus → Induction of labor

Antepartum Hemorrhage

Summary

<table>
<thead>
<tr>
<th>Symptom/Sign</th>
<th>Placenta previa</th>
<th>Abruptio placenta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>Minimal</td>
<td>Severe</td>
</tr>
<tr>
<td>Contraction</td>
<td>Absent or mild</td>
<td>Hard, rapid, often tetanic</td>
</tr>
<tr>
<td>Blood</td>
<td>Bright red</td>
<td>Port wine</td>
</tr>
<tr>
<td>Coagulation</td>
<td>Normal</td>
<td>Abnormal</td>
</tr>
<tr>
<td>Concealed hemorrhage</td>
<td>Almost never</td>
<td>&gt; 20% of time</td>
</tr>
</tbody>
</table>

Premature Onset of Labor (POL)

Diagnosis

- Gestation > 20 weeks, < 37 weeks
- Contraction and cervical change

8. Which of the following is the greatest risk factor for premature onset of labor?

A. Concurrent STD
B. Low socioeconomic status
C. Uterine anomaly
D. History of mid second trimester spontaneous loss of pregnancy

8. Which of the following is the greatest risk factor for premature onset of labor?

- A. Concurrent STD (28%)
- B. Low socioeconomic status (20%)
- C. Uterine anomaly (14%)
- D. History of mid second trimester spontaneous loss of pregnancy (39%)
Risk Factors for POL

“Greatest Risk"

- Prior preterm birth*
  - recurrence risk of 17-37%
- Concurrent STD*
- African-American race*
- Prepregnancy weight < 50 kg*
- Bleeding*

9. Regarding the risks and benefits of corticosteroid therapy for fetal lung maturation, which of the following is NOT true?

A. Corticosteroid therapy is recommended for all pregnant women between 24 and 34 weeks gestation who are at risk of preterm delivery within 7 days
B. Corticosteroid therapy has been associated with an increased risk of neonatal infection
C. Multiple courses of corticosteroids have been associated with fetal adrenal suppression
D. Corticosteroids accelerate the appearance of pulmonary surfactant in the fetal lungs

Preterm Labor

Symptomatic Management

- Hydration/Complete Bedrest
- Screen and treat for infections
- Tocolytics
  - Magnesium sulfate – 48 hours
- Corticosteroids (24-34 weeks EGA)
  - Betamethasone 12 mg IM q 24h x two doses
- Antibiotics
  - ROM – Broad Spectrum
  - No ROM – GBS prophylaxis as indicated

10. Which of the following statements is most accurate regarding postpartum hemorrhage (PPH)?

A. PPH occurs in 10-15% of vaginal deliveries
B. PPH is defined as a 10% change in hematocrit between admission/postpartum period
C. Active management of the third stage does NOT impact the risk of PPH
D. PPH is an uncommon cause of maternal morbidity and mortality

10. Which of the following statements is most accurate regarding postpartum hemorrhage (PPH)?

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D. PPH is an uncommon cause of maternal morbidity and mortality
Postpartum Hemorrhage

**Definition**
- ACOG Practice Bulletin, October 2006
  - 10% change in hematocrit between admission/postpartum period
  - Need for erythrocyte transfusion
- Early - first 24 hours after delivery
- Late - after 24 hours but before 6 weeks after delivery

**Early Postpartum Hemorrhage**

**Etiology**
- Uterine atony (Tone)
- Uterine overdistention
- Hydramnios
- Multiple gestation
- Fetal macrosomia
- Oxytocin use
- High parity
- Rapid or prolonged labor
- Intra-amniotic infection
- Retained placental fragments (Tissue)
- Including abnormal placentation
  - Accreta
  - Increta
  - Percreta

**Coagulopathy (Thrombin)**
- Hereditary
- DIC
- Sepsis
- Abruption
- HELLP

**Early Postpartum Hemorrhage**

**Etiology**
- Lacerations of vagina and cervix (Trauma)
  - Forceps
  - Fetal macrosomia
  - Precipitous labor and delivery
  - Episiotomy
- Uterine rupture
- Uterine inversion

**Treatment Approach**
- Uterine Massage
  - Bimanual
- Oxytocics (Medical Uterotonic Therapy)
- Inspect for lacerations
- Surgical Intervention

**Postpartum Hemorrhage**

**Treatment - Medical Uterotonic Therapy**
- Oxytocin
  - IV, IM or intramyometrial
- Misoprostol (Cytotec, PGE1)
  - per rectum (400 mcg after placenta and 100 mcg at 4 and 8 hours postpartum, total 800-1,000 mcg)*
- Methylergonovine
  - contraindicated in presence of hypertensive disease state
- 15-methyl PGF2α (Carboprost or Hemabate)
  - IM or intramyometrial
- Dinoprostone (PGE2)

**Postpartum Hemorrhage**

**Prevention**
- Correct Anemia
- Avoid routine episiotomy
- Infant to breast
- Routine use of pitocin after delivery of the placenta
- Active Management of Third Stage

---

Third Stage of Labor Management

**Expectant**
- Await separation
- Leave cord uncut
- Spontaneous placental delivery
- Oxytocin/breast after placental separation

**Active**
- Oxytocin with shoulder delivery
- Cord clamped and cut early
- Controlled cord traction

Postdates Pregnancy > 42 weeks

- Accurately date everyone
  - Early sonograms help (Level A)
- Antenatal Fetal testing between 41 and 42 weeks (Level C)
  - q 4 - 7 days depending on method
  - most do MBPP q 3-4 days
- Induction – Risk of routine induction (C/S) in the era of cervical ripening agents is lower than previously reported
  - Cervical Ripening – Improves success of inductions (Level B)
  - Bishop Score of 8
  - Oxytocin
  - Nonpharmacologic methods of labor induction may be helpful

Cervical Ripening Agents

*Induction is indicated, cervix is unfavorable*

- Total score > 8 (Max score 15), probability of vaginal delivery after labor induction is similar to that after spontaneous labor

<table>
<thead>
<tr>
<th>Dilatation (Points)</th>
<th>0 cm</th>
<th>1-2cm</th>
<th>3-4cm</th>
<th>≥5cm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effacement</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Consistency</td>
<td>Firm</td>
<td>Medium</td>
<td>Soft</td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td>Post</td>
<td>Mid</td>
<td>Anterior</td>
<td></td>
</tr>
<tr>
<td>Station*</td>
<td>-3</td>
<td>-2</td>
<td>-1/0</td>
<td>+1/+2</td>
</tr>
</tbody>
</table>

* Station reflects a -3 to +3 scale

Modified from Bishop EH. Pelvic scoring for elective induction. Obstet Gynecol 1964;24:267

Induction

- **Level A Evidence**
  - Postterm pregnancies with unfavorable cervix can undergo induction OR expectant management
  - Prostaglandins (PG) can be used to promote cervical ripening AND induce labor
  - Delivery should be effected if there is evidence of fetal compromise or oligohydramnios

- **Level C Evidence**
  - Reasonable to initiate fetal monitoring between 41-42 wks
  - Many practitioners use twice weekly
  - NST & AFI (MBPP) should be adequate
  - Many recommend induction or prompt delivery in patients with a favorable cervix and no other complications

Answers

1. D
2. C
3. C
4. B
5. B
6. A
7. D
8. A
9. B
10. B