**General**

**Anemia in Pregnancy**
- Occurs because of a greater expansion of plasma volume
- This occurs during the late second to early third trimester
- Hemoglobin <10.5 in the 2nd trimester = anemic
- Usually treat with iron supplement
- Also take 400-800mcg of folate

**Assessment for Pregnancy Risk**
- Use the following tests in all women
  - Hematocrit/hemoglobin and MCV
  - Assessment for asymptomatic bacteriuria
  - Rhesus type and red cell antibody screen
  - Assessment for immunity to rubella and varicella
  - Testing for syphilis, hepB, and chlamydia
  - HIV
- Test used for at risk women
  - Thyroid function test
  - Gonorrhea
  - TB, toxoplasmosis, hepC, BV, trich, herpes, Chagas
- At risk women
  - Thyroid issues type 2 DM, HepC, TB

<table>
<thead>
<tr>
<th>SIGN</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate</td>
<td>Absent</td>
<td>&lt;100</td>
<td>&gt;120</td>
</tr>
<tr>
<td>Respiratory rate</td>
<td>Absent</td>
<td>Weak, irregular</td>
<td>Good, crying</td>
</tr>
<tr>
<td>Muscle tone</td>
<td>Flaccid</td>
<td>Arms and legs flexed</td>
<td>Well flexed</td>
</tr>
<tr>
<td>Reflex irritability</td>
<td>No response</td>
<td>Grimace</td>
<td>Cough or sneeze</td>
</tr>
<tr>
<td>Skin color</td>
<td>Blue, pale</td>
<td>Hands and feet blue</td>
<td>Completely pink</td>
</tr>
</tbody>
</table>

**High Risk Pregnancies**
- Pre-existing maternal disorders
  - HTN, DM, STDs, pyelo, surgical problems, genital tract abnormalities, exposure to teratogens, exposure to mercury, prior stillbirth, prior preterm delivery, prior neonate with genetic or congenital disorder, polyhydramnios and oligohydramnios, multiple pregnancy, prior birth injury
- Physical and social characteristics
- Age (>35)
- Problems in previous pregnancies (SAB)
- Problems that develop

**Prenatal Care**

**Components of prenatal evaluations**
- Week 4-28: 1 prenatal visit a month
- Weeks 28-36: 1 prenatal visit every 2 wks
- Weeks 36-40: 1 prenatal visit every week
- Evaluations
  - 8-12 wks → IOB, physical exam, pelvic exam, blood type, hgb, STD screening, urine test (bacteriuria), pap
    - Maybe u/s dating if LMP is unknown
  - Optional genetic counseling → if >35 or family hx
    - Talk about additional genetic screening tests, blood tests, chorionic villus sampling, u/s, amniocentesis
  - First 2 trimester visits (up to 28 wks)
    - Weight, BP, fetal heart beat, growth of uterus, check urine for protein and glucose
  - 15-20 wks
    - Will also be offered the Quad screen test/horizon to screen for genetic and spinal cord abnormalities
    - Anatomic u/s between 18-20wks to view baby’s organs and measure growth
  - 27-28 wks
    - Glucose challenge test for GDM, hgb may be rechecked, can do a pelvic
    - Sign up for prenatal classes
  - 28-36 wks
    - Every 2 wks → growth, heartbeat, position of baby
  - 36 wks
    - GBS test, pelvic exam, repeat STD testing, position and size of baby
  - 36-40 wks
    - Monitoring or weight and BP, size, position, heart rate, cervix dilation check

**Estimated date of delivery (EDD)**
- 280 days from the onset of the LMP, and 266 days from the date of conception
- Naegle’s Rule
  - Count back 3 months from the LMP and add 7 days
  - June 20th LMP → March 27th
- Ultrasound estimation of EDD in the first half of pregnancy is superior to dating based on LMP or physical exam (and is most accurate in the first trimester)
  - The u/s EDD should be used if it differs from that calculated from the LMP by more than 5-7 days in the first trimester and by more than 10-14 days in the second trimester (or by 8%)
### Timing of routinely recommended screening & diagnostic studies

<table>
<thead>
<tr>
<th>Test</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuchal Translucency scan</td>
<td>11 wks to 13+6 wks</td>
</tr>
<tr>
<td>GDM</td>
<td>26-28 wks</td>
</tr>
<tr>
<td>GDM</td>
<td>screening</td>
</tr>
<tr>
<td>GDM</td>
<td>drink glucose solution, one hour later</td>
</tr>
<tr>
<td>GDM</td>
<td>have a blood test to measure your blood</td>
</tr>
<tr>
<td>GDM</td>
<td>sugar level, &lt;130-140 is considered normal</td>
</tr>
<tr>
<td>Fetal Non-Stress Test</td>
<td>performed at 28 wks, tests movement,</td>
</tr>
<tr>
<td>Fetal Non-Stress Test</td>
<td>heart rate, and reactivity of heart rate</td>
</tr>
<tr>
<td>Fetal Non-Stress Test</td>
<td>to movement for 20-30 minutes</td>
</tr>
<tr>
<td>Rhogam shot</td>
<td>at 28-29 wks</td>
</tr>
<tr>
<td>Biophysical Profile</td>
<td>typically after 32 wks</td>
</tr>
<tr>
<td>First Trimester Screen</td>
<td>combines AFP blood draw and u/s for nuchal</td>
</tr>
<tr>
<td>First Trimester Screen</td>
<td>translocyancy</td>
</tr>
<tr>
<td>Chorionic Villus Sampling</td>
<td>removes chorionic villi cells from the</td>
</tr>
<tr>
<td>Chorionic Villus Sampling</td>
<td>placenta to check for chromosomal</td>
</tr>
<tr>
<td>Chorionic Villus Sampling</td>
<td>abnormalities and genetic disorders</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>guided by u/s, thin catheter is inserted</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>through the cervix into the placenta and</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>the villi cells are gently suctioned</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>(can also be done through the abdomen)</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>very high level of accuracy</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>can be done between 10 &amp; 13 wks from LMP,</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>can be done earlier than amniocentesis</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>can also do paternity testing</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>risk of miscarriage</td>
</tr>
<tr>
<td>U/S</td>
<td>transvaginal during early stages (good to</td>
</tr>
<tr>
<td>U/S</td>
<td>diagnose ectopic or molar pregnancies)</td>
</tr>
<tr>
<td>Urinalysis</td>
<td>used to assess bladder or kidney infections,</td>
</tr>
<tr>
<td>Urinalysis</td>
<td>DM, dehydration, and preeclampsia</td>
</tr>
<tr>
<td>Blood test</td>
<td>looks for anemia, toxoplasmosis, Rh factor,</td>
</tr>
<tr>
<td>Blood test</td>
<td>glucose, iron, hemoglobin, immunity to</td>
</tr>
<tr>
<td>Blood test</td>
<td>rubella, STDs</td>
</tr>
<tr>
<td>Quad Screen</td>
<td>16-18th wk – adds inhibin-A to the triple</td>
</tr>
<tr>
<td>Quad Screen</td>
<td>screen</td>
</tr>
<tr>
<td>Quad Screen</td>
<td>lowers the false positive rates for downs</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>follow up for an abnormal triple test to</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>determine if specific genetic disorders may</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>be present in their baby</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>u/s guided needle to enter the amniotic sac</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>to remove a sample of the amniotic fluid</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>done between 14-20 wks</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>detects chromosome abnormalities, neural</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>tube defects, downs, cystic fibrosis</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>provides access to DNA for paternity testing</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>prior to delivery</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>miscarriage is the main risk, may lead to</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>cramping, leakage of fluid, minor irritation</td>
</tr>
<tr>
<td>Amniocentesis</td>
<td>at puncture site</td>
</tr>
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</tr>
<tr>
<td>First Trimester Screen</td>
<td>can also ID cardiac disorders, but NOT neural</td>
</tr>
<tr>
<td>First Trimester Screen</td>
<td>tube defects</td>
</tr>
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<td>First Trimester Screen</td>
<td>performed between the 11th &amp; 13th wk</td>
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</tbody>
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### Weight Change Guidelines

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<th>Category</th>
<th>Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary restriction</td>
<td>Increased risk of low birth weight</td>
</tr>
<tr>
<td>Singleton</td>
<td>Neurologically impaired infants</td>
</tr>
<tr>
<td>BMI &lt;18.5</td>
<td>28-40 lbs</td>
</tr>
<tr>
<td>BMI 18.5-24.9</td>
<td>25-35 lbs</td>
</tr>
<tr>
<td>BMI 25-29.9</td>
<td>15-25 lbs</td>
</tr>
<tr>
<td>BMI &gt;30</td>
<td>11-20 lbs</td>
</tr>
<tr>
<td>Twins</td>
<td>Normal BMI 37-54 lbs</td>
</tr>
<tr>
<td>Risk of miscarriage</td>
<td>Preterm birth, chromosomal abnormalities, genetic disorders, multiple pregnancies, verifies date, assesses amniotic fluid</td>
</tr>
</tbody>
</table>

### Prenatal vitamins

<table>
<thead>
<tr>
<th>Category</th>
<th>Contains folic acid</th>
</tr>
</thead>
<tbody>
<tr>
<td>singleton</td>
<td>400 – 800 mcg/day for ALL women of child bearing age</td>
</tr>
<tr>
<td>Risk of miscarriage</td>
<td>600mg/day for pregnant women</td>
</tr>
<tr>
<td>Risk of miscarriage</td>
<td>4mg/day for women at high risk (previous pregnancy with NTD, DM, anti-seizure meds)</td>
</tr>
<tr>
<td>Risk of miscarriage</td>
<td>Prescribe to avoid neural tube defects</td>
</tr>
<tr>
<td>Risk of miscarriage</td>
<td>Anencephaly: severely underdeveloped brain</td>
</tr>
<tr>
<td>Risk of miscarriage</td>
<td>Spina bifida: incomplete closure of spinal cord and spinal column</td>
</tr>
<tr>
<td>Risk of miscarriage</td>
<td>Neural tube closure occurs w/in 1mo of conception</td>
</tr>
<tr>
<td>Risk of miscarriage</td>
<td>Supplementation should occur 1mo prior to conception and continued at least 2-3mo into pregnancy</td>
</tr>
</tbody>
</table>
**Labor & Delivery**

**Rupture of Membranes**
- AKA amniorrhexis, is the rupture of the amniotic sac
- Occurs spontaneously at full term during labor
- When the amniotic sac ruptures, production of prostaglandins increases leading to more contractions
- SROM → spontaneous ROM
- PROM → Premature ROM
- AROM → artificial ROM

**Meconium**
- Failure to pass can be CF or Hirschsprung’s
- Normally retained in infant’s bowel until after birth, if it is expelled prior to labor it may be a sign of fetal distress
- Meconium aspiration syndrome can occur → medical staff may aspirate the meconium from nose and mouth
- First sign of CF is often a meconium ileus

**Oxytocin/Pitocin**
- A hormone produced in the hypothalamus and secreted from the posterior pituitary in a pulsatile fashion
- Administration is a proven method of labor induction and produces periodic uterine contractions
- First demonstrable at about 20 wks gestation, it continues to increase until 34 wks at which point it levels off until spontaneous labor begins
- It is most commonly given intravenously, steady state concentrations are reached within 40 minutes
- The dose is increased until labor progress is normal or contractions occur at 2-3 minute intervals
- Low dose
- High dose (can lead to uterine tachysystole)
- Pulsatile (rarely used)

**Two steps of labor induction**
1. Cervical ripening
   - Membrane stripping
   - Transcervical catheter
   - Misoprostol
   - Dinoprostone
2. Induction of labor
   - Mechanical → membrane stripping, amniotomy
   - Oxytocin

**Breech Presentations**
- Fetus whose buttocks are adjacent to the birth canal
- Frank Breech → feet are up near head, buttocks is at the canal (50-70% are in this position)
- Complete Breech → feet are down at canal (5-10%)
- Diagnosis made on physical exam and u/s
- Incomplete Breech → straight legs (can lead entrapment of the shoulders or head because of their much larger diameters, increases the risk of hypoxic injury and delivery related trauma, also provides space for umbilical cord
- Because the hips are flexed and the knees are extended or flexed, the thighs and trunk pass through the canal simultaneously
- Chance occurrence in up to 15% of cases
- Risk factors
  - Preterm gestation
  - Previous breech presentation
  - Uterine abnormality
  - Placental abnormality, Multiparity
  - Extremes of amniotic fluid (polyhydramnios, oligohydramnios)
  - Contracted maternal pelvis
  - Fetal anomaly, Extended fetal legs
  - Older maternal age, Fetal growth restriction
- Strategies
  - External cephalic rotation before labor with a trial of labor → c-section
  - External cephalic rotation before labor with a trial of labor → trial of labor and vaginal breech → c-section
  - Scheduled c-section without a trial of labor

**Obstetric Complications**

**Septic abortion**
- Complicated form of SAB accompanied by an intrauterine infection
- Uncommon with SAB, more frequent with induced abortions
- Management
  - Assess hemodynamic stability, give fluids or blood products if needed
  - Obtain blood and endometrial cultures
  - Administer broad-spectrum IV antibiotics (usually the same as PID abx)
  - Surgical evacuation of the uterine connects, risk of perforation is high (evacuation should begin promptly)

**Intrapartum fetal heart rate monitoring**

<table>
<thead>
<tr>
<th>Heart rate pattern</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>V → Variable decelerations</td>
<td>C → Cord compression/prolapic</td>
</tr>
<tr>
<td>E → Early decelerations</td>
<td>H → Head compression</td>
</tr>
<tr>
<td>A → Accelerations</td>
<td>O → Okay</td>
</tr>
<tr>
<td>L → Late decelerations</td>
<td>P → Placental insufficiency</td>
</tr>
</tbody>
</table>

**Malposition/malpresentation**
- See breech
- Transverse fetal lie → curvature of spine goes over cervix or anterior trunk goes over cervix
- Very unstable
- Diagnosis can be made with leopold maneuvers
- Most will need c-section delivery
### PROM
- ROM prior to the onset of regular uterine contractions
- Management depends on gestational age
- Diagnosis is based upon characteristic history (water breaking) and a speculum exam visualizing the os
  - Can also test the fluid pH, amniotic fluid has a range of 7-7.3 (vagina is usually 3.8-4.2 and urine is 5-6) – this is called the nitrazine
  - Fern test → amniotic fluid dries like a fern on the slide
- If between 23-34 wks, give a corticosteroid for RDS
- Give antibiotics
- Urgent delivery if:
  - Intrauterine infection, placenta abruption, nonreassuring fetal testing, high risk of cord prolapse

### Preterm Labor
- **Interventions**
  - Antenatal corticosteroid therapy, GBS prophylaxis, magnesium sulfate for neuroprotection
- **Evaluation**
  - Evaluate for risk factors for preterm birth (anxiety, depression, low SES, no partner, surgery, multiple gestations, polyhydramnios, uterine anomaly, PPROM, STIs, premature cervical dilation, bacteriuria, periodontal disease, placenta previa, abruption, previous preterm delivery, substance abuse, smoking, <18, >40, AA, low BMI, anemia
  - Dilation >3cm = preterm labor
  - Assess bleeding, membranes, fetal HR, maternal BP
  - GBS screening if not done in the past 5 wks, urine cx for asymptomatic bacteriuria, drug testing, **fetal fibronectin testing** (used to distinguish true preterm labor from those in false labor)
- >34 wks → no need for antenatal corticosteroids, admitted for immediate delivery after an observation period of 4-6 hrs, if no progressive cervical dilation, pt can be sent home if abruption, chorioamnionitis, and PPROM have been excluded
- <34 wks → further evaluation with sonographic measurement of cervical length (if >20-30mm, increased risk for preterm birth), also fetal fibronectin testing is done
  - Course of betamethasone
  - Tocolytic drugs for up to 48 hrs so that the betamethasone can achieve its max fetal effect
  - Antibiotics for GBS
  - Mag sulfate in pregnancies 24-32 wks to provide neuroprotection against cerebral palsy
- <37 = preterm
- <34-36 = late preterm
- <34 = early preterm
- **Prevention**
  - Smoking cessation, progesterone supplementation, reduction of multiple gestation, cerclage with previous preterm and short cervix
  - **spontaneous preterm birth has been associated with increased risk of maternal cardiovascular morbidity and mortality**
  - **preterm birth is the leading cause of direct neonatal death**

### Retained Placenta
- The third stage of labor is the interval from delivery of the infant to expulsion of the placenta
- Delayed separation and expulsion of the placenta is a potentially life threatening event because it interferes with normal postpartum contraction of the uterus which can lead to hemorrhage
- Defined as lack of expulsion of the placenta within 30 minutes
- May take 60 minutes if it is a second trimester delivery
- Types of retained placenta
  - Trapped or incarcerated placenta → a separated placenta that has detached completely from the uterus but was not delivery because the cervix has begun to close
  - Placenta adherens → placenta is adherent to the uterine wall but easily separated manually
  - Placenta accrete → the placenta is pathologically invading the myometrium due to a defect in the decidua – it cannot easily be separated
- Complications → two most common complications of a retained placenta are postpartum hemorrhage and postpartum infection
- Indications for intervention →
  - Patients with severe bleeding → the retained placenta should be manually removed as soon as possible
  - Patients without severe bleeding → determine if the placenta is merely trapped or still adherent, can wait for 60 minutes to intervene (but intervene right away if patient begins to bleed), can apply controlled cord traction
- Address contributing factors → excessive uterine/cervical contraction, atony
- **Management**
  - 1 – cord traction & drug therapy (oxytocin)
  - 2 – manual (hand goes into uterus)
  - 3 – Instrumental (uses large headed forceps)

### Postpartum Fever
- Postpartum febrile morbidity is defined as a fever of >100.4 or >38 on any two of the first 10 days postpartum (excluding the first 24 hrs)
- If fever is present, a physical exam should be performed to find the source and optimal therapy
- Surgical site infections may occur at episiotomy, lacerations, or c-section
- Typical physical exams will show cellulitis with redness and induration, may be accompanied by tenderness, purulent incisional drainage
- The following should be considered:
  - UTI, wound infection, mastitis or breast abscess, endometritis, septic pelvic thrombophlebitis, drug reaction, c. diff, complications related to anesthesia
**Gestational Trophoblastic Disease (non-neoplastic)**
- Lesions characterized by abnormal proliferations of trophoblast of the placenta
- Includes benign, nonneoplastic lesions, hydatidiform mole
- Lesions arise from fetal, NOT maternal tissue
- Benign nonneoplastic lesions → frequently diagnosed as an incidental finding on an endometrial curettage or hysterectomy specimen (exaggerated placental site, placental site nodule)
- Hydatidiform mole → result from abnormalities in fertilization, they are essentially benign but may carry an increased risk of persistent or malignant GTN
  - Complete, partial, invasive mole

**Postpartum Blues/Depression**
- The postpartum period is defined as the first 12 months after birth
- Pathogenesis is unknown, may be hormonal
- **Baby blues**: a transient condition characterized by mild depressive symptoms (dysphoria, sadness, tearfulness, anxiety), insomnia, decreased concentration
  - These symptoms develop in 40-80% of women within 2-3 days of delivery
  - Symptoms usually peak over the next few days and resolve within 2 wks
- **Risk factors**
  - Depressive symptoms before, stress around child care, psychosocial impairment, hx or PMS, or OCPs → mood changes, depressive syndromes predating pregnancy, family hx of depression
  - At higher risk for developing post partum depression
- **Postpartum Depression** → Often do not recognize the disorder because the sx overlap with many of the normal discomforts of the puerperium (fatigue, difficulty sleeping, low libido)
  - Risk factors
    - History of depression, hx of abuse, young age, immigrant status, unplanned pregnancy, thoughts of termination, stressful life events, lack of social and financial support, no partner, unemployment
    - Mode of delivery is not associated
  - Can lead to impaired maternal-infant bonding and child development, marital problems, and suicide
  - Use the Edinburgh Postnatal Depression Scale

**HIV**
- Recommended c-section and no breast-feeding
- ART → reduction of perinatal transmission and treatment of maternal HIV disease
- All pregnant HIV infected women should receive a combination antiretroviral drug regimen, regardless of CD4 count
- Perinatal HIV infection can occur during pregnancy, labor and delivery, or breastfeeding, but the use of ART greatly reduce risks
- Postexposure prophylaxis should be administered to the infant after birth
- Recommend initiation of ART as soon as HIV is diagnosed in pregnancy

**Dystocia**
- When the shoulders don’t come out after the head
- Goal is to prevent asphyxia and permanent Erb’s palsy or death while avoiding traumatic injuries
- **Risk factors**
  - High birth weight, DM, operative vaginal delivery, previous shoulder dystocia, abnormal progress of labor, postterm pregnancy, male fetal gender, maternal obesity and high gestational weight gain, pelvimetry
  - Diagnosis = turtle sign
- Management = most interventions are intended to disimpact the anterior shoulder from behind the symphysis pubis by rotating the fetal trunk and delivering the posterior arm and shoulder
  - Goal is to finish in 5 minutes, no neck rotation

**Endometritis**
- Infection of the decidua (pregnancy endometrium)
- Postpartum endometritis is a common cause of postpartum febrile morbidity
- Typically a polymicrobial infection
- GC/CT are uncommon causes of postpartum endometritis, but common causes of endometritis NOT related to pregnancy
- **Risk factors**
  - C-section (especially if performed after onset of labor, BV)
  - Chorioamnionitis, prolonged labor, PPROM, multiple cervical exams, internal fetal monitoring, large amount of meconium in amniotic fluid, manual removal of the placenta, low SES, DM or severe anemia, preterm, postterm, HIV, GBS colonization, nasal carriage of staph aureus, heavy vaginal colonization of strep or e. coli
- Clinical findings
  - Postpartum fever, tachycardia, midline lower abdominal pain, uterine tenderness
  - Purulent lochia, chills, headache, malaise, anorexia
  - Uterus may be slightly soft and subinvoluted, can lead to excessive uterine bleeding
  - WBC can be elevated (but this can by a common finding in postpartum women)
  - Elevated lactic acid is a marker for serious infection
  - A fever in the first 24 hrs does not matter since this is common, but >100.4 for any two out of ten days is considered postpartum febrile morbidity
- Treatment
  - Broad spectrum abx (clindamycin & gentamicin OR ampicillin & sulbactam)
  - Get blood cultures if needed
- Give any c-section patients we recommend abx prophylaxis

**GBS**
- Gram positive coccus that frequently colonized the human genital and GI tract and upper respiratory tract of young infants (occurs in 10-40% of women)
- It is a frequent cause of asymptomatic bacteriuria, cystitis, and pyelonephritis (there is an association between untreated asymptomatic bacteriuria and preterm delivery or low birth weight)
- Can cause meningitis, and endocarditis
- Used to lead to an increased risk of chorioamnionitis and early postpartum infection
- GBS in pregnant women → neonatal GBS infection
- Screen women between 35-37 weeks
- Women with GBS bacteriuria anytime in pregnancy should routinely receive prophylactic intrapartum antibiotics
- Treat with ampicillin or penicillin IV, prophylaxis is begun at hospital admission and continued every 4 hrs until delivery

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- The postpartum period is defined as the first 12 months after birth
- Pathogenesis is unknown, may be hormonal
- **Baby blues**: a transient condition characterized by mild depressive symptoms (dysphoria, sadness, tearfulness, anxiety), insomnia, decreased concentration
  - These symptoms develop in 40-80% of women within 2-3 days of delivery
  - Symptoms usually peak over the next few days and resolve within 2 wks
- **Risk factors**
  - Depressive symptoms before, stress around child care, psychosocial impairment, hx or PMS, or OCPs → mood changes, depressive syndromes predating pregnancy, family hx of depression
  - At higher risk for developing post partum depression
- **Postpartum Depression** → Often do not recognize the disorder because the sx overlap with many of the normal discomforts of the puerperium (fatigue, difficulty sleeping, low libido)
  - Risk factors
    - History of depression, hx of abuse, young age, immigrant status, unplanned pregnancy, thoughts of termination, stressful life events, lack of social and financial support, no partner, unemployment
    - Mode of delivery is not associated
  - Can lead to impaired maternal-infant bonding and child development, marital problems, and suicide
  - Use the Edinburgh Postnatal Depression Scale

**HIV**
- Recommended c-section and no breast-feeding
- ART → reduction of perinatal transmission and treatment of maternal HIV disease
- All pregnant HIV infected women should receive a combination antiretroviral drug regimen, regardless of CD4 count
- Perinatal HIV infection can occur during pregnancy, labor and delivery, or breastfeeding, but the use of ART greatly reduce risks
- Postexposure prophylaxis should be administered to the infant after birth
- Recommend initiation of ART as soon as HIV is diagnosed in pregnancy

**Dystocia**
- When the shoulders don’t come out after the head
- Goal is to prevent asphyxia and permanent Erb’s palsy or death while avoiding traumatic injuries
- **Risk factors**
  - High birth weight, DM, operative vaginal delivery, previous shoulder dystocia, abnormal progress of labor, postterm pregnancy, male fetal gender, maternal obesity and high gestational weight gain, pelvimetry
  - Diagnosis = turtle sign
- Management = most interventions are intended to disimpact the anterior shoulder from behind the symphysis pubis by rotating the fetal trunk and delivering the posterior arm and shoulder
  - Goal is to finish in 5 minutes, no neck rotation

**Endometritis**
- Infection of the decidua (pregnancy endometrium)
- Postpartum endometritis is a common cause of postpartum febrile morbidity
- Typically a polymicrobial infection
- GC/CT are uncommon causes of postpartum endometritis, but common causes of endometritis NOT related to pregnancy
- **Risk factors**
  - C-section (especially if performed after onset of labor, BV)
  - Chorioamnionitis, prolonged labor, PPROM, multiple cervical exams, internal fetal monitoring, large amount of meconium in amniotic fluid, manual removal of the placenta, low SES, DM or severe anemia, preterm, postterm, HIV, GBS colonization, nasal carriage of staph aureus, heavy vaginal colonization of strep or e. coli
- Clinical findings
  - Postpartum fever, tachycardia, midline lower abdominal pain, uterine tenderness
  - Purulent lochia, chills, headache, malaise, anorexia
  - Uterus may be slightly soft and subinvoluted, can lead to excessive uterine bleeding
  - WBC can be elevated (but this can by a common finding in postpartum women)
  - Elevated lactic acid is a marker for serious infection
  - A fever in the first 24 hrs does not matter since this is common, but >100.4 for any two out of ten days is considered postpartum febrile morbidity
- Treatment
  - Broad spectrum abx (clindamycin & gentamicin OR ampicillin & sulbactam)
  - Get blood cultures if needed
- Give any c-section patients we recommend abx prophylaxis

**GBS**
- Gram positive coccus that frequently colonized the human genital and GI tract and upper respiratory tract of young infants (occurs in 10-40% of women)
- It is a frequent cause of asymptomatic bacteriuria, cystitis, and pyelonephritis (there is an association between untreated asymptomatic bacteriuria and preterm delivery or low birth weight)
- Can cause meningitis, and endocarditis
- Used to lead to an increased risk of chorioamnionitis and early postpartum infection
- GBS in pregnant women → neonatal GBS infection
- Screen women between 35-37 weeks
- Women with GBS bacteriuria anytime in pregnancy should routinely receive prophylactic intrapartum antibiotics
- Treat with ampicillin or penicillin IV, prophylaxis is begun at hospital admission and continued every 4 hrs until delivery

**Postpartum Depression**
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### Postpartum Hemorrhage
- OB emergency, major cause of maternal morbidity and one of the top 3 causes of maternal mortality
- Primary PPH → Occurs in the first 24 hrs (early)
- Secondary PPH → Occurs after 24 hrs up to 12 wks
- PPH → >500mL of blood after vaginal delivery, or >1,000mL after C-section
- Another definition is a 10 point decline in postpartum hematocrit
- Pathogenesis
  - Normally, hemostasis occurs upon placental separation (blood vessel compression of the myometrium), and local decidual hemostatic factors (type-1 plasminogen activator inhibitor)
  - PPH occurs when there is a disturbance in one or both of these mechanisms
  - Can also be caused by delivery trauma
- Causes
  - Atony (most common) – lack of effective contraction of the uterus after delivery
  - Trauma – lacerations, surgical incisions, or uterine rupture
  - Coagulopathy
- Risk Factors
  - Retained placenta/membranes, Failure to progress to the second stage of labor, Morbidly adherent placenta, Lacerations
  - Instrumental delivery, Macrosomia
  - Hypertensive disorders, Induction of labor
  - Prolonged first or second stage of labor
- Diagnosis → when it causes pallor, lightheadedness, weakness, palpitations, diaphoresis, etc.
- If uterus is firm, evaluate for other etiologies
- If uterus is NOT firm, initiate bimanual fundal massage and continue infusing oxytocin 15 units
  - Consider need for transfusion, DIC panel (PT/INR, PTT, fibrinogen, D-dimer, platelet)

### Fetal Distress
- Typically means the fetus is not receiving adequate oxygen during pregnancy or labor
- Often times it is detected through an abnormal fetal heart rate
- Benefits of FHR monitoring → recognize hypoxia by heart rate patterns, monitor mother’s contractions
- Precursors to fetal distress
  - Anemia, oligohydramnios, pregnancy induced HTN, IUGR, meconium stained amniotic fluid
- Treatment
  - Changing mom’s position, ensuring mom is hydrated, giving mom O2, amnioinfusion, tocolysis (to stop preterm labor), intravenous hypertonic dextrose
  - Emergency c-section

### Prolapsed Umbilical Cord
- Cord slips ahead of the presenting part of the fetus and protrudes into the cervical canal or vagina
- This is an OB emergency because the cord is vulnerable to compression, umbilical vein occlusion, and umbilical artery vasospasm (which can compromise fetal oxygenation)
- Usually causes membrane rupture
- Usually caused by either anatomy (the presenting part does not adequately fill the pelvis), or when OB interventions are performed that dislodge the presenting part
  - Risk factors: malpresentation (breech), prematurity, low birth weight, second twin, pelvic/uterine deformities, low lying placenta, fetal abnormalities, multiparity, polyhydramnios, long cord, iatrogenic rupture of membranes
  - Presents with abrupt onset of severe, prolonged, fetal bradycardia, or moderate to severe variable decelerations
- Call for assistance and prepare for emergency delivery

### Choriocarcinoma
- Gestational trophoblastic neoplasia
- Highly malignant epithelial tumor, it can arise from any type of trophoblastic tissue (molar pregnancy, abortion, ectopic, preterm)
- More common after a complete mole rather than a partial mole
- Most aggressive histologic type of GTN and is characterized by early vascular invasion and widespread mets
- Clinical presentation is often due to bleeding from a metastatic site
- Most commonly presents following evacuation of a complete hydatidiform mole with the following characteristics
  - Pre-evacuation uterine size is larger than gestational age
  - Hcg level >100,000
  - Bilateral ovarian enlargement
  - AUB
- Mets → lung & vagina are most common, CNS, hepatic (do imaging for lung - CXR)
Perineal Laceration/Episiotomy Care

- An occult injury to the anal sphincter occurs frequently at the time of vaginal delivery and can contribute to anal incontinence.
- Initially, exam the perineum and vagina to thoroughly determine the extent of injury (should include a rectovaginal exam), the anal sphincter can be disrupted even though the perineum is intact.
- We do not use abx prophylaxis for repair of first and second degree OB lacerations, for repair of a third or fourth degree laceration, administer a single dose of broad spectrum abx (cefotetan).
- Absorbable synthetic suture is preferred.
- **Episiotomy**
  - Recommend avoiding routine episiotomy since there is no proven benefit, only use them in deliveries with high risk of severe perineal laceration.
  - Median (or midline) episiotomy is the most commonly used one, it is easier to repair and yields a better cosmetic result.
  - Mediolateral – benefit is that it is directed away from the anal sphincter.

Normal Pregnancy: Common Concerns

<table>
<thead>
<tr>
<th>Concern</th>
<th>Trimester</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amenorrhea</td>
<td>All</td>
<td>Amenorrhea caused by estrogen, progesterone, and HCG build up; first sign of pregnancy</td>
</tr>
<tr>
<td>Heartburn</td>
<td>All</td>
<td>Progesterone relaxes lower esophageal sphincter allowing gastric contents to reflux in esophagus; exacerbated by gravid uterus applying pressure to stomach</td>
</tr>
<tr>
<td>Urinary frequency</td>
<td>All</td>
<td>Caused by increases in blood volume and GFR as well as pressure on bladder from gravid uterus; investigate dysuria or suprapubic pain for UTI</td>
</tr>
<tr>
<td>Vaginal discharge</td>
<td>All</td>
<td>Asx milky white discharge (leukorrhea) normal, investigate foul-smelling or pruritic discharge</td>
</tr>
<tr>
<td>Constipation</td>
<td>All</td>
<td>Results from slowed GI transit, dehydration from N/V, iron supplementation from prenatal vitamins</td>
</tr>
<tr>
<td>Hemorrhoids</td>
<td>All</td>
<td>Caused by constipation, decreased venous return from increasing pelvic pressure, and decreases in activity</td>
</tr>
<tr>
<td>Backache</td>
<td>All</td>
<td>Caused by hormonally induced relaxation of joints and ligaments, increased lordosis, enlarged breasts</td>
</tr>
<tr>
<td>Nausea and/or vomiting</td>
<td>1</td>
<td>Caused by hormonal changes, slowed GI peristalsis, alterations in smell/taste, etc.; hyperemesis gravidarum &gt;5% loss of pregnancy weight and can be fatal</td>
</tr>
<tr>
<td>Breast tenderness/tingling</td>
<td>1</td>
<td>Pregnancy hormones stimulate growth of breast tissue causing swelling, tingling, aching, tenderness; can be exacerbated by increased blood flow</td>
</tr>
<tr>
<td>Fatigue</td>
<td>1/3</td>
<td>Changes in energy requirements, sedative effects of progesterone, changes in body mechanics due to gravid uterus, sleep disturbances</td>
</tr>
<tr>
<td>Lower abdominal pain</td>
<td>2</td>
<td>Rapid growth in 2nd trimester causes tension and stretching of round ligament causing sharp or cramping pain w/changes in movement</td>
</tr>
<tr>
<td>Abdominal striae</td>
<td>2/3</td>
<td>Stretching of skin and tearing of collagen fibers; may itch, sensitive to sunlight; may persist or fade overtime;</td>
</tr>
<tr>
<td>Contraction</td>
<td>3</td>
<td>Braxton-hicks contractions rarely assoc. w/labor; evaluate if contractions become regular or painful</td>
</tr>
<tr>
<td>Loss of mucous plug</td>
<td>3</td>
<td>Passage of mucous plug usually occurs during labor but can occur before; not assoc. w/labor as long as no regular contractions, bleeding, loss of fluid</td>
</tr>
<tr>
<td>Edema</td>
<td>3</td>
<td>Decreased venous return, obstruction of lymphatic flow, reduced plasma colloid oncotic pressure contribute to lower extremity edema; hand and face edema should be investigate for preeclampsia</td>
</tr>
</tbody>
</table>

- Parts of normal pregnancy: morning sickness, dizziness, weight gain, swelling in the feet, acid reflux
- **Hyperemesis Gravidarum** (0.5%, greatly under-reported)
### Hypertension
- **Chronic HTN in pregnancy**
  - Present prior to conception and/or before 20th week of gestation
  - R/o secondary causes: kidney dz, renal artery stenosis, lupus, thyrotoxicosis
  - Requires closer monitoring to ensure that HTN does not progress
    - Greatest risk: 25% develop superimposed preeclampsia
  - Management
    - Optimize diet, exercise, control weight gain
    - Continue safe pharmacotherapy only if indicated (determined by specialist)

- **Gestational HTN**
  - After 20th week of gestation
    - Systolic BP >/= 140
    - Diastolic BP >/= 90
    - No proteinuria, no end-organ damage
  - Occurs in 6-17% nulliparous women, 2-4% multiparous
  - Most commonly occurs in first pregnancies, depends on health status, diet, stress, etc.

- Mild-moderate HTN has good prognosis and usually requires no treatment
  - If maintained at 140/90 and no end-organ damage no immediate tx indicated

- When taking BP follow correct techniques – pregnant patient should be sitting for at least 15min, right size cuff, confirmation with 2-3 readings

- Treatment
  - Treatment of HTN in non-pregnant patient is to prevent adverse effects in 5yrs
  - Duration of conditions is finite and relatively short so that no maternal benefits could be expected from antihypertensive therapy for mild chronic HTN during 9mo pregnancy
  - Treat both chronic HTN and gestational HTN
  - Consider risks vs. benefits of tx

### Gestational Diabetes (5%)
- Glucose intolerance first recognized in pregnancy
  - Postprandial hyperglycemia resulting from impaired insulin release and increasing insulin resistance facilitated by pregnancy hormones
  - Incidence as high as 9.2% in some areas of US
  - Risk for developing diabetes later on in life

- **Screening @ 24-28wks gestation**
  - 50g oral glucose test, randomly ingested
    - Abnormal >140 mg/dL → Proceed to 3hr Oral Glucose Tolerance Test
    - Gestational DM >200 mg/dL

- Management
  - Strict diet control
  - Patient monitor BS
  - Insulin in needed

- Monitor w/frequent US for fetal growth
  - Macrosomia: fetal weight greater than 90th percentile or over 400gm
  - Complications: hypoglycemia, hyperbilirubinemia, delayed pulmonary maturation (induced early birth), birth injury – shoulder dystocia (C sections minimize injury to mother and baby)

### Preeclampsia
- HTN after 20wks and signs of end-organ damage in previously normotensive patient
  - >140/90 confirmed on repeat exam
  - >160/110 confirmed dx

- End organ damage
  - Proteinuria >0/3g in 24hrs
  - Platelet count <100,000/mcL
  - Serum creatinine >1.1 mg/dL (or doubling of baseline)
  - LFT evaluation, Pulmonary edema, Cerebral or visual sx’s

- **Evaluation (important to prevent impaired uteroplacental blood flow or placental infarction)**
  - Urine dipstick for proteinuria (1+), edema unresponsive to position, edema in face/hands
  - Sudden weight gain, HA, blurry vision, hyper-reflexive or ankle clonus (hypertensive crisis)
  - Measure fundal height (to check for intrauterine growth restriction) → If blood flow restricted, fetus will not grow

- **Diagnosis**
  - Difficult to dx, no effective method for screening, important to establish baseline and prevent from progressing
  - Most common in first pregnancies
    - 25-60% recurrence rate of preeclampsia
    - Recurrence usually less severe
    - Common <25yo and >35yo, pre-existing HTN, obesity, DM, thyroid dz

- **Pharmaceutical tx** (Consider risk vs. benefit, informed decision)
  - Medications to use in moderate-severe cases: aldotet, nifedipine, labetalol
  - Medications usually avoided in 1st trimester, pts typically monitored closely before medications used
  - Tx if worried about HTN crisis or progression to eclampsia (3% will progress if not treated, w/tx progression 0.6%)
  - Do NOT use HCTZ (do not diuresis pregnant patients, will cause further volume depletion)
  - Refer to OB specialist for high risk pregnancy
  - Tx of HTN crisis → Hydralazine 10mg IV or Labetalol 20mg IV
### Eclampsia
- Preeclampsia w/seizure, coma, or death
- Prevention (most important)
  - Close monitoring, bed rest in L lateral
  - If BP >160/110, initiate IV therapy
  - Hydralazine 10mg IV, then drip
  - Delivery only definitive cure
- Seizures
  - Tonic clonic, short duration
  - If status results use what is necessary to stop seizure
  - Resuscitate mom to resuscitate baby
- Management of seizures
  - Magnesium sulfate IV 6gms
    - Does not abort current seizure, used to prevent subsequent seizures (10% will have subsequent)
    - Safer than phenytoin, diazepam
    - Low cost, no cardiac monitoring, no sedation
    - Decreases risk of cerebral palsy in offspring
    - If overdose, calcium gluconate 1g IV and supportive tx
- HELLP syndrome
  - Hemolysis, elevated liver enzymes, low platelets
  - Sx's: edema of face and hands, HA, visual changes, N/V, RUQ pain, decreased urine output

### Vaginal bleeding in first trimester
- DDx
  - Normal implantation of embryo (short-lived, lasts 1 day)
  - Post-coital bleeding
  - Vaginal, vulvar, cervical lesions or lacerations
  - Non-pregnancy bleeding, rectal bleeding
  - Spontaneous abortion (miscarriage)
  - Ectopic pregnancy
  - Gestational trophoblastic disease
- Rh (-)
  - Maternal Type and Screen for Rh factor for all pts w/vaginal bleeding
    - If Rh (+) do not need Rho-Gam
    - If Rh (-) needs Rho-Gam
      - Will have normal first pregnancy, develop Abs
      - If second pregnancy Rh (+) Abs attack infant blood
  - Rh Immunoglobulin (Rho-Gam) administered @ 28-29wks to all Rh (-) mother as prophylaxis
    - Blood product – must get informed consent
    - Immunoglobulin also indicated for any other condition that causes maternal and fetal mixing of blood
      - Ectopic pregnancy
      - Spontaneous/therapeutic abortion
      - CVS, amniocentesis
      - Trauma (MVC, domestic abuse)
    - If Rho-Gam not given, severe fetal anemia (hemolytic anemia of newborn), fetal hydrops, fetal death can occur

### Abortion
- Termination of pregnancy <20wks
- Spontaneous abortions
  - Premature expulsion of products of conception
  - 10% of all clinically recognized pregnancies, rate much higher than medically documented (1/5)
  - 80% occur in 1st trimester
- RF’s: smoking, infection (rubella, toxoplasmosis, CMV), maternal systemic dz (uncontrolled DM, thyroid storm), immunologic abnormalities of fetus, drug abuse (cocaine)

### Types of abortion
#### Threatened AB
- Serial Quantitative hCG titers q48hrs
- Serum progesterone, Serial US
- Blood type and Rh status

#### Abortion (miscarriage)
- Natural AB
  - Allow products to pass naturally
  - Typically <10 weeks gestation, can take days-wks
  - Heavy bleeding, serial hCG titers
  - F/U US to confirm completion of abortion
  - F/U pelvic exam
- Dilation and curettage
  - Single-step, clears POC
- Endometritis
  - Infection s/p abortion
  - Treat w/IV abx, hospitalization (treat sepsis)
- All Rh (-) receive immunoglobulin

#### Etiology of AB
- Most common reason unknown
- If etiology known, usually due to genetic abnormalities of fetus
- Environmental: drug use, toxic exposure, Uncontrolled endocrine disorders: DM, thyroid dz, Uterine defects
- Infection: CMV, parovirus, rubella
- Autoimmunities: anti-phospholipid ab’s (can cause placental thrombosis and infarction)

### Cervical insufficiency
- Painless dilation of cervix
  - Often in 2nd trimester, accounts for 15% second trimester loss
  - Fetal membranes may become exposed to vaginal flora, infection, PROM
- RF’s
  - Prior trauma to cervix: lacerations at delivery, LEEP, cone biopsy
  - Connective tissue disorders
  - In utero exposure to DES (diethylstilbestrol – synthetic estrogen)
    - Last prescribed in 1971, can cause clear cell adenocarcinoma (CCA) – rare vaginal and cervical cancer
- Dx: hx, PE, US
- Management:
  - Can perform cervix sutting to prevent in patients who are at risk or suspected cervical opening, in subsequent pregnancies in pts with known cervical insufficiency
  - If cervical insufficiency not treated, pregnancy will self terminate and end in fetal demise
  - Cerclage

### Hyperemesis Gravidarum
- Dry bland food/oral rehydration are first line
- Then antiemetics and IV fluids
  - Meds → pyridoxine/doxylamine, promethazine
  - Odanestron (but it may lead to cleft palate)
  - Metoclopramide can also be used
### Vaginal bleeding in second & third trimester
- **DDx**
  - First trimester reasons, vasa previa, placenta previa, placental abruption
- **Evaluation:** transvaginal US for bleeding → Assess cervix, placenta, cord (Doppler flow)

#### Placental Abruption
- **RF’s:** increased age and parity, HTN, PROM, prior abruption, cocaine use, cigarette smoking, thrombophilias, trauma
- **Types of abruption**
  - Partial abruption most common → falls, insult to uterus
  - Hematoma concealed → may not have bleeding but can still have fetal distress, abdominal cramping
- **Management**
  - Varies on gestational age and status of mother and fetus → if fetus viable, C section ASAP
  - Always stabilize mother first
  - Expectant management in preterm infant
    - Betamethasone — steroids to for lungs
    - Tocolysis — stop contractions
    - Bed rest
    - Fetal monitoring
    - Mode of delivery if fetus viable (C section)

#### Vasa Previa
- Fetal vessels course through membranes, present at internal os
- Compression of umbilical cord - 2 arteries, 1 vein (O2 to baby)
- Obstetrical emergency **(high fetal mortality)**
- Occurs in 1:2500 births w/fetal mortality rate 95% if not dx prenatally
- **Dx via Doppler US**
- Close monitoring, delivery via C section if possible

#### Placenta previa
- 100% mortality if patient does not have C section
- Should be suspected w/bleeding in second half of pregnancy
- Bleeding can vary (small amounts vs. full hemorrhage shock)
- RF’s: prior C section/uterine surgery/curettage, maternal age, multiparty, uterine abnormalities (fibroids), smoking, IVF, multiple gestation pregnancy
- **Dx:** Transabdominal US evaluation (Sn 95%)
- **Vaginal exam and speculum exam CONTRAINDICATED**
  - Can cause hemorrhage and death
  - If pt presents w/bleeding and unknown Hx of prenatal care, DO NOT perform pelvic
  - Stabilize with IV access and trans-abdominal US

**Assoc. w/accreta, increta, percreta**
- **Placenta accreta:** through endometrium, into myometrium
- **Placenta increta:** into myometrium
- **Placenta percreta:** through serosa to adjacent organs

#### Multiple Gestations
- **Incidence**
  - Overall incidence of multiple births in US 3%
  - Increasing during past 30yrs as a result of reproductive techniques and ovulation induction
  - Twins occur in 1/80 births
- **Types**
  - 2/3 of twins dizygotic (fraternal)
  - Formed by fertilization of two ova by two sperm
  - Incidence increased in those w/FHx of twins, those taking fertility drugs, mothers w/above average weight and height, African American women
  - Monozygotic twins (formed by the fertilization of one ovum that splits) occur randomly
  - Assoc. w/fetal transfusion syndrome and discordant fetal growth
  - Triplets
- **Maternal complications**
  - Most common complications **spontaneous abortion and preterm birth**
  - Preeclampsia and anemia also occur with greater frequency
- **Fetal complications**
  - Intrauterine growth restriction
  - Cord accidents
  - Death of one twin
  - Congenital anomalies
  - Abnormal or breech presentation
  - Placental abruption of previa

#### Ectopic Pregnancy
- **RFs:** prior ectopic, DES, PID, tubal surgery, IUD
- **MC site:** fallopian tube
- Vaginal bleeding + abdominal pain + amenorrhea
- Adnexal tenderness
- β-hCG > discriminatory zone without visualized intrauterine pregnancy (IUP): ectopic or nonviable fetus
- β-hCG < discriminatory zone without visualized IUP: ectopic or early IUP
- **Rx:** MTX, surgery

#### Molar Pregnancy
- **Painless vaginal bleeding**
- Hyperemesis
- Preeclampsia
- Large uterus
- Ultrasound: "snowstorm," "cluster of grapes," "honey-combed"
  - ↑ β-hcg
- Dilation and curettage
- Failure of β-hcg to ↓: choriocarcinoma or invasive disease
### Cesarean section

- Most common gynecologic surgery (30% of all births)
  - **Indications:**
    - Failure to progress (30%)
    - Previous hysterotomy (30%)
    - Mal-presentation (11%)
    - Non-reassuring fetal heart tracing (10%)
    - Maternal infection/chorioamnionitis, abnormal placenta, multiple gestations, fetal bleeding problems, mechanical obstruction to vaginal delivery
  - **Types of incision**
    - Skin incision → Vertical incision, Pfannenstiel incision
    - Uterine incision → Low transverse (horizontal), classical (vertical)
      - Classical – preterm
      - Low transverse – normal for full term
        - Can have a vaginal birth after
  - **Risks of C-section**
    - Rare: Infection, hemorrhage, organ damage, DVT, anesthesia risks, fetal injury, maternal/fetal death
    - Temporary nerve damage at skin common → most of feeling returns in 6mo
  - **Future issues assoc. w/C-section**
    - Abnormal placentaation → Greater risk that placenta will attach to scar in uterus (previa)
    - Uterine rupture → After 2 C-section’s do not recommend a vaginal delivery, do not induce labor
    - Abdominal scarring
    - Unexplained stillbirth with multiple C-sections (rare)
  - **Mal-presentation at term**
    - Vertex (96%)
    - Breech (3.5%)
    - Face (0.3%
    - Very difficult to discern until dilated, use speculum to confirm
  - **Diagnosis of fetal presentation and position → abdominal palpation/Leopold maneuvers, US**

### Physiology of labor

- Third trimester: process of cervical growth and remodeling accelerated
- Influenced by placental hormones and relaxin
- Prostaglandin E2 (PGE2) acts synergistically with hormones to promote cervical change
- Increase in production and concentration of oxytocin receptors
- Increased response in uterine tissue to oxytocin pulses
- Generates greater pressure and tension on the cervix
- Increasing frequency of oxytocin pulses increases frequency of contractions
- Decidua responds to oxytocin by releasing PGF2a (increases responses to oxytocin by myometrium)

### Vocabulary words of labor

- **Attitude:** posturing of joints and relation of fetal position with all joints in flexion
- **Lie:** refers to longitudinal axis of fetus in relation to mother
- **Presentation:** part of fetus lying over inlet of pelvis or at os
- **Point of reference or direction:** arbitrary point on presenting part used to orient the maternal pelvis (occiput, mentum, scaprum)
- **Position:** relation of point of reference to eight octanes of pelvic inlet
- **Engagement:** occurs when biparietal diameter is at or below inlet of true pelvis
- **Station:** presenting part to the level of ischial spines measured in plus or minus centimeters

### Preparation for labor

- **Lightening:** patient may perceive descent of fetus into her pelvis
- **Lower uterine segment expands**
- **Fetus applies significant pressure onto sacrum → back pain**
- Increased pressure on maternal bladder → urinary frequency

### Labor

- Contractions → dilation and effacement of cervix
- Usually accompanies descent and expulsion of fetus
- 3 stages
  - **First stage:** onset of contractions until complete cervical dilation
    - Defined from hospital admission
    - Latent phase: gradual cervical change (0-4cm)
    - Active phase: rapid cervical change
      - Can take minutes to hours
      - Faster in multiparous women
  - **Second stage:** interval between full cervical dilation and delivery of infant
  - **Third stage:** time from delivery of baby to separation and expulsion of placenta
    - Placenta separation: uterus becomes globular, sudden gush of blood
    - Normal time 5-10min, **consider to be prolonged if >30min** → If assisted with Pitocin, may take 2-4min

### Pain management of Labor

- **Natural/no medications**
- **IV narcotics (stadol/morphine)**
  - Changes sensorium in between contractions, does not block pain from contractions
  - Allow women in latent phase labor to go to sleep
  - Do not give to women in active labor, will also sedate baby
  - Combine with Phenergan
- **Nitrous oxide**
  - Tank near bed, quick acting, easily reversible, patient controlled, great option in early labor
- **Epidural/spinal**
  - **Epidural**
    - Catheter threaded into dural space continuous through entire labor
    - Anesthetized from xyphoid and done
    - Women can increase anestesia
    - Onset 10-20min
  - **Spinal**
    - One shot, can wear off before labor completed
    - Instant relief within minute
- **Pudendal nerve block**
  - Long needle
  - Gives temporary blockage to S1-S4
Episiotomy
- Necessary for assisted delivery, high risk of tearing through rectum
- Middio-lateral episiotomy have less pain and blood loss
- Rarely needed, only indicated if 3rd or 4th grade lesions expected to result from labor

<table>
<thead>
<tr>
<th>Degree</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Vaginal mucous membrane and skin of perineum</td>
</tr>
<tr>
<td>2nd</td>
<td>Subcutaneous tissue of the perineal body</td>
</tr>
<tr>
<td>3rd</td>
<td>Involves fibers of the external rectal sphincter</td>
</tr>
<tr>
<td>4th</td>
<td>Through rectal sphincter exposing the lumen of the rectum</td>
</tr>
</tbody>
</table>

Average length of labor
- **First stage**
  - Latent phase: 6.4 (nulliparous), 4.8hrs (multiparous)
  - Active phase 6.4hrs (nulliparous), 4.6hrs (multiparous)
- **Second stage**
  - 50 min (nulliparous), 20 min (multiparous)

Types of abnormal labor
- Protracted/prolonged labor (Labor >24hrs)
  - May be due to prolonged latent phase (>20hrs primigravida, >14hrs multipara)
  - May be due to protraction disorder (protracted cervical dilation in active phase of labor and protracted fetal descent)
- Arrested labor
  - Cessation in the birth process, esp. caused by weakened, diminished, or absent contractions

Poor prognosis in first stage of labor
- **Prolonged latent phase**
  - Failure of thinning of lower uterine segment, cervical effacement, no dilation with hours of contractions
- **Primary dysfunctional labor**
  - Most common in first labor
  - Slow progress during active phase of labor
  - Usually associ. w/infficient contractions
- **Secondary arrest**
  - Appropriate progress of labor in initial phase but arrest of dilation after 7cm
  - Usually associ. w/mal-presentation and cephalopelvic disproportion

Risk factors for abnormal labor
- Older maternal age (>35yo)
- Pregnancy complications
- Epidural anesthesia (can slow down progression of labor)
- Macrosomia (baby bigger than 4000gm)
- Pelvic contractures, Occiput posterior, Nulliparity, Short stature
- Obesity   Mediate time to dilate from 4-10cm with BMI >25
  5.4hrs, BMI >40 7.7hrs
- High station at fully dilated
- Post-term <41wks, Chorioamnionitis, Induction of labor
- Early membrane rupture (can be ruptured up to 12-18hrs, after 18hrs risk of infection)

Thromboembolism prevention & treatment
- Pregnant women 4-5X more likely to develop VTE compared to non-pregnant women
  - Can occur at any time during pregnancy and postpartum period
  - Increased risk due to Virchow’s triad: venous stasis, vascular injury, hypercoagulability
  - Other RF’s during pregnancy: previous hx of VTE during pregnancy, age >/=35, smoking, black race obesity, C-section delivery, immobilization, parity >4
- **Treatment**
  - During pregnancy
    - Treatment of choice: unfractionated heparin (SQ/IV) or low molecular weight heparin
      - LMW heparin has lower risk of developing HIT, bone loss, fewer bleeding complications
    - Warfarin contraindicated (pregnancy category X)
  - Management at term
    - If on LMWH change to UFH at 36-37wks to take advantage of shorter half life
    - Scheduled induced C-section
      - Prophylactic dose: stop LMWH 12hrs before induction or C-section
      - Treatment dose: stop LMWH 24hrs before induction or C-section
    - If on UFH and spontaneous labor occurs, stop heparin and use protamine if necessary
      - In high risk patients, can change to IV UFH and stop 4-6hrs before delivery
- **Post-partum**
  - LMWH or UFH can be restarted
    - 6-12hrs following uncomplicated delivery, 12hrs following epidural removal, 24hrs following C-section
  - Bridge to warfarin, stop LMWH/UFH once INR therapeutic
    - Warfarin does not enter breast milk, continued for 6wks if pt had thrombotic event during pregnancy
  - 21-84X more common in postpartum, highest risk in first 2wks   Important for early ambulation
  - Leading cause of maternal mortality, prophylaxis recommended for high risk patient (hx of DVT, pulmonary emboli)
  - “After pains”
    - More common in multiparas
    - Lochia – sloughing off of decidua
    - Lochia rubra: bright red bleeding
    - Lochia serosa: less bloody
    - Lochia alba: yellowish-white
    - 10th day postpartum
    - Pay attention to odor – endometritis until proven otherwise
**Breastfeeding**

- **Recommendations** → infants by exclusively breast for first 6mo
  - Most important for the first 2-3 days so baby can get colostrum (important immune factors, helps laconium to move), 3-4wks of breastfeeding provides great protein for baby
  - Push breastfeeding for women who have significant hx or FHx of allergies
- **If bottle-feeding rather than breastfeeding**
  - Milk leakage, engorgement, pain peak at 3-5days postpartum
  - Need well-fitting bra, ice packs and analgesics prn, avoid nipple stimulation and expression of milk, do not use medication for lactation cessation
- **Breast surgery and breast feeding**
  - Augmentation mammoplasty
  - Can attempt with breast reduction
- **Colostrum**
  - Deep yellow liquid, higher mineral and protein content, persists for about 5 days
  - Antibodies and IgA (provides immunity to baby)
- **Breast milk**
  - Suspension of fat and protein in CHO-mineral solution, 600mL per day
  - 75 cals/100mL, 4.5g of fat, **all vitamins except Vit K**, major proteins, low iron concentration
- **Contraindications**
  - HIV, radioactive substances, drugs/alcohol, infant with galactosemia, untreated TB, breast cancer
- **Contraception and breastfeeding**
  - Not needed in first 3wks, fertility unpredictable after 3wks
  - Options: progestin-only pills, depo-provera, hormonal implants, estrogen-progestin contraceptives
- **Mastitis**
  - Incidence about 1%, usually occurs in 3rd or 4th week
  - Unilateral pain assoc. w/chills, high fever, erythema, hard breast
  - 10% will develop an abscess → most common pathogen = Staph aureus
  - Tx: doxycillin 500mg 4X daily, erythromycin if penicillin allergic, clindamycin if penicillin allergic
- **Studies**
  - Infant to exclusively breast for first 6mo
  - Can attempt with breast reduction
  - Augmentation mammoplasty
  - Generally considered safe
  - Studies have failed to demonstrate risk to fetus in 1st trimester
  - Duteglis, levothyroxine, prenatal vitamins

**Teratogen**

- Substance that interferes w/normal prenatal development
- Causes formation of developmental abnormalities (birth defects) to fetus/embryo
- Drugs, chemicals, radiation, viruses/infection
- Abnormalities due to medications depend on agent, dose, and timing in development - can be difficult to assess damage
- FDA pregnancy categories:
  - **Category A**
    - Generally considered safe
    - Studies have failed to demonstrate risk to fetus in 1st trimester
    - Duteglis, levothyroxine, prenatal vitamins
  - **Category B**
    - Animal studies show no risk, human studies have no data
    - Animal studies show risk, human studies do not show risk
  - **Category C**
    - Animal studies have shown adverse effects to fetus, no human data
    - Potential benefits may outweigh risk
  - **Category D**
    - Positive evidence of human fetal risk based on investigational or marketing experience
    - Potential benefits may outweigh risk
  - **Category X**
    - Studies in animals or humans have demonstrated fetal abnormalities
    - Risks outweigh benefits
  - **Pathophysiology** → Medications can cross placenta by passive diffusion, diffusion depends on molecular size and properties
    - Small molecules likely to cross, large molecules unlikely to cross → <500 Da readily crosses, 500-1000Da slowly crosses, >1000 Da rarely crosses
    - Lipophilic drugs cross more readily vs. hydrophilic drugs

**Prescribing During Pregnancy**

- **Pharmacokinetics during pregnancy**
  - Changes affect absorption, distribution, metabolism of medications
  - Begin at conception and typically return to normal 2-8wks post-partum
  - **Pharmacokinetic changes**
    - Decrease in gastric pH and increase in motility
    - Volume distribution altered
      - Plasma volume increases after 4wks
      - 25% increase in RBC count, plasma volume increases in greater proportion → physiologic anemia
    - Serum albumin decreases in 2nd trimester
    - Clearance changes → Increase in GFR
    - Increase in CYP 3A4 affected

**Medications to avoid**

- ACE/ARB → fetal renal damage
- Anticonvulsants
- Chemo
- Estrogen
- Methimazole
- NSAIDs → 3rd trimester, premature closing of PDA
- Statins
- Accutane
- Warfarin
- Tetracyclines → stained teeth
- DIETHYLSTILBESTROL (DES) → cervical cancer, genetic abnormalities
- Live vaccines
- Misoprostal
- Thalidomide
Considerations During Lactation

- **General Principles**
  - Almost any drug present in maternal serum will transfer into breast milk to some extent
  - Drug concentrations in breast milk vary by time of day and stages of breastfeeding
  - A drug that is safe for use during pregnancy may not be safe for use during breastfeeding

- **Medication considerations**
  - Transfer of medications into breast milk occurs primarily by passive diffusion
    ▪ Pass from high concentrations in maternal serum to lower concentrations in breast milk
  - Drug concentration in breast milk largely depends on maternal serum drug concentration
    ▪ Medications that have large Vd tend to have lower concentrations in maternal serum
  - Medications that do not enter breast milk: highly protein bound, large MW’s, poorly lipid-soluble
  - Factors affected amount of drug excreted into breast milk
    ▪ Degree of protein binding in maternal plasma (unbound drugs more easily transfer)
    ▪ Molecular weight (<200 freely pass, >500 little/no passage)
    ▪ Lipid solubility (highly lipophilic drugs transfer more readily)
    ▪ Maternal plasma concentration (higher maternal concentrations = higher concentrations in breast milk)
    ▪ Drug half-life (longer half life = longer in breastmilk)
    ▪ Drug pH (weak bases readily transfer)

**Medication concerns during lactation**

- Opiates
- SSRIs
- Antiepileptics
- Antibiotics
- Endocrime (bromocriptine, estrogen)
- Methotrexate
- Anxiolytics
- Cardiovascular (beta blockers)

**Minimizing infant exposure**

- Use topical therapy whenever possible (intranasal, creams)
- Choose medications w/ short half-life, high protein binding, low lipid solubility, lower RID
- Administration of medication:
  - Daily dose for mother administer before longest sleep period
  - Multiple daily doses for mother: breastfeed immediately prior to dose
- Consider medications safe for use in infants