ALLOIMMUNIZATION

- Formation of maternal antibodies to red blood cell antigens
- Antepartum or intrapartum fetal-maternal bleeding
  - Childbirth
  - Miscarriage/Abortion
  - Ectopic Pregnancy
  - Bleeding associated w/ placenta previa or abruption
  - Amniocentesis
  - Abdominal Trauma
  - External Cephalic Version
- Blood product transfusion
GENERAL INFORMATION

- First pregnancy generally not affected
- Process of antibody production and transfer may be accelerated in subsequent pregnancies
- Maternal antibodies bind to antigens on fetal Red Blood Cells
- Fetal RBCs hemolyze causing fetal anemia and hyperbilirubinemia
- Elevated bilirubin can lead to kernicterus
  - Bilirubin deposition in the basal ganglia
  - Can cause permanent neurologic symptoms and death
FETAL ANEMIA

- Fetal liver produces RBC
  - Production of other proteins decreases → decreased oncotic pressure
  - Can lead to ascites, SQ edema, or pleural effusion

- High-output heart failure
  - Results in effusions, edema, and ascites as hydrostatic pressure increases

- Hydrops Fetalis
  - Combination of fluid accumulation in at least two extravascular spaces
History

- Could involve several hundred blood groups
  - Rhesus (Rh) most common
  - Others – Kell, Duffy, Kidd
  - Lewis and Lutheran don’t cause hemolytic disease in the newborn
**Rh Antigen**

- D antigen is most likely involved
- Isoimmunization can occur if fetus is Rh+ and mother is Rh-
- Exposure to fetal RBC can cause development of maternal antibodies in 15% of cases
DIAGNOSIS

- History
- Testing maternal blood type and antibody status
- Determine paternal erythrocyte antigen status
- Further evaluation with antibody titers
  - Critical titer is usually between 1:8 and 1:32
  - If initial titer is \( \leq 1:8 \) monitor with titer assessment every 4 weeks
AMNIOTIC FLUID ASSESSMENT

- Amniotic fluid obtained during amniocentesis
- The Optic Density values are plotted on a curve (Liley curve)
**MCA Doppler & Ultrasound**

- Doppler used to measure the peak systolic velocity in the fetal middle cerebral artery
- Less viscous blood (due to anemia) has higher velocity
- Ultrasound is helpful in detecting signs of anemia
Percutaneous Umbilical Blood Sampling
Fetal blood can be sampled under ultrasound guidance
Can directly assess fetal anemia
**Intrauterine Transfusion**

- Indicated when the fetus is in significant jeopardy for hydrops and fetal death
- Can be performed intraperitoneally or intravascularly (via PUBS)
PREVENTION

- Administration of IgG Anti-D immune globulin (RhoGAM) confers passive immunity
- Prevents active antibody response by the mother
- Given to mothers who are Rh- when the infant is Rh+
- Rhogam should be administered after any event that may be associated with fetomaternal hemorrhage
- 300 µg RhoGAM dose neutralizes 15 ml of fetal red cells
RhoGAM

- 300 μg dose given within 72 hours of delivery has reduced the risk of sensitization from 15% to 2%
- 300 μg dose given at 28 WGA has further reduced the risk to 0.2%
EVALUATION OF FMH

- Kleihauer-Betke test
  - KOH is added to sample of maternal blood
  - Maternal cells lyse and become “ghost cells”
  - Fetal cells remain intact and can be counted
  - Size of hemorrhage is calculated

- Indirect Coombs test to determine if RhoGAM dose was adequate

- Flow Cytometry Laser based biophysical technology employed in cell counting. Accurate enough to establish if fetal maternal hemorrhage is increasing
QUESTIONS??