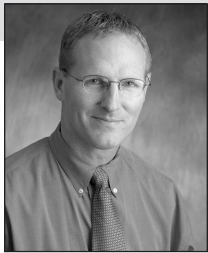




Newsletter

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Contemporary Management of Red-Cell Alloimmunization: A Case of Obstetrical Perils Conquered

Joseph K. Hwang, F.A.C.O.G.

The treatment of fetal anemia due to red-cell alloimmunization, or hemolytic disease of the fetus and newborn, is considered a significant victory in medical history. This once vexing condition is now not only treatable but also preventable and results in excellent outcomes for the patient.

Red-cell alloimmunization is a condition in which the red cells of the fetus are destroyed by maternal antibodies. These antibodies occur because of a blood incompatibility between the mother and fetus, such as an Rh-D negative mother who is carrying an Rh-D positive fetus. Approximately 15 percent of Caucasian women in the United States have Rh-D negative blood type.

When a 'sensitized' Rh-D negative woman is pregnant with an Rh-D positive fetus, fetal cells are passed into maternal circulation and trigger an immunological response from the mother against the fetus. Since immunoglobulin (IgG) can easily pass through the placental barrier, maternal IgG will hemolyze fetal red blood cells to the point of severe anemia. All of the clinical outcomes of isoimmunization stem from the consequences of severe anemia.

Abnormal ascites prior to paraumbilical blood sampling and intrauterine fetal transfusion



However, fetal anemia, from alloimmunization or other etiologies, can now be reliably predicted, diagnosed and treated using non-invasive and invasive techniques with minimal risk. At-risk women should have a thorough history of previous deliveries including miscarriages and termination. Rh-D immunoglobulin administration should also be confirmed.

Additionally, as part of the new obstetrics intake panel, a maternal titer that tests for unusual antibodies should be completed. If the test is positive, the results should be confirmed and discussed with the blood bank to identify the antigen.

Once a woman is identified as 'sensitized', a perinatal consultation may be necessary. However, presence of a

Contemporary Management of Red-Cell Alloimmunization: A Case of Obstetrical Perils Conquered *continued*

maternal antibody does not always mean that subsequent pregnancies will be affected. For example, a heterozygous father has 50 percent chance of passing the deletion to the next offspring, while the other 50 percent is not at risk and does not need any intervention.

To access potential risk, fetal genotyping

can be done as early as 11 weeks of gestation using chorionic villus sampling. If the fetal genotype is confirmed, then high-resolution ultrasound with doppler studies can identify the at-risk fetus. Middle cerebral artery (MCA) peak systolic velocimetry can now reliably diagnose fetal anemia. This technique has revolutionized the field and obviated the need for invasive amniocentesis to determine the presence of bilirubin in the amniotic fluid.

Throughout the duration of the pregnancy, an MCA Doppler study along with fetal survey can be used to monitor the

However, the baby demonstrated findings consistent with hydrop fetalis, including scalp edema, pleural effusion and ascites. MCA Doppler suggested fetal anemia. Peak systolic velocity of MCA was above two standard deviations from normal range. This necessitated FBS and possible transfusion. The patient was admitted to the Maternity Triage and Treatment Unit at Mercy Medical Center—Des Moines, while the Blood Center of Iowa prepared the necessary blood for transfusion. At that time, estimated fetal weight was less than 200 grams.

Fetal circulation was accessed through the placental cord insertion site. The fetal blood was sampled and the hemoglobin was found to be 2.7g/L, consistent with severe anemia. The fetus was given approximately 10 cc of packed RBC. This amount was not sufficient to overcome anemia, however volume overloading a fetus that is already in high cardiac output failure can be detrimental. The procedure was repeated in one week, allowing the fetus to recover from the

fetus. When fetal anemia is present, velocity increases due to decreased blood viscosity. The presence of rising peak velocity will then require cordocentesis, or fetal blood sampling (FBS) to sample the actual fetal hemoglobin.

FBS has been in practice since the 1980s. This technique can be life-saving for the affected fetus and has a complication rate of less than one percent. If significant anemia is confirmed, than irradiated, leukocyte-filtered, CMV negative, O negative blood can be transfused directly into fetal umbilical vein. This procedure can be repeated every two to three weeks until the fetus maintains a

stable hemoglobin level. FBS transfusions are continued until the 35th week of pregnancy, when the risk of transfusion outweighs the risk of prematurity. By correcting severe anemia, the clinical manifestation of fetal hydrops is dramatically reduced. Anasarca, pleural effusion, cardiac regurgitation and abnormal fetal biophysical profiles are reversed once adequate hemoglobin is established.

A recent case at the Perinatal Center of Iowa illustrates the prenatal diagnosis and treatment of severe fetal anemia from alloimmunization.

transfusion. Then the fetus received another course of transfusion with higher volume to normalize the hemoglobin level.

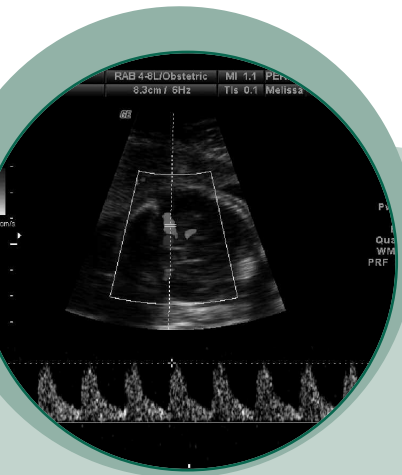
With each transfusion, the MCA Doppler returned to normal range and the hydropic changes reversed back to normal. Fetal behavior also improved, demonstrating better fetal activity. Until 35 weeks of gestation, the fetus received a total of seven transfusions, consisting of approximately 400 cc of packed RBC. The patient then underwent Cesarean delivery due to breech presentation. After delivery, the baby was given one more round of transfusion until the hemoglobin stabilized. Despite two courses of betamethasone therapy, the baby had respiratory distress syndrome, but went home in stable condition.

At the Perinatal Center of Iowa, our experience in fetal diagnosis and treatment extends from our commitment to provide our patients with the best and most up-to-date knowledge in the field of perinatal medicine. Our dedicated sonographers, genetic counselors, nurse practitioner and physician assistant help identify challenging obstetrical patients and provide them with compassionate

care and excellent knowledge in the field. Our service includes prenatal diagnosis for aneuploidy and structural defects, including chorionic villous sampling and amniocentesis. We also specialize in fetal echocardiogram, fetal therapy including fetal blood sampling and intrauterine transfusion, fetal bladder shunt placement, high-order multiple gestations and other maternal medical conditions that require intense maternal and fetal surveillance.

¹ Mari G et al., Noninvasive diagnosis by Doppler ultrasonography of fetal anemia due to maternal red-cell alloimmunization. Collaborative Group for Doppler Assessment of the Blood Velocity in Anemic Fetuses. *N Engl J Med.* 2000 Jan 6;342(1):9-14.

Resolution of abdominal ascites following paraumbilical blood sampling and intrauterine fetal transfusion



Middle cerebral artery Doppler is used to assess fetal anemia

CASE REPORT:

The patient, a 35-year-old G3P1 with a positive titer on her routine screening, was sensitized from a previous pregnancy that required a blood transfusion. Her antibody tests were positive for both the D and C antigen, which are both capable of mounting a strong immunological response. Her referring physician monitored her titer levels and obtained serial ultrasounds. At 17 weeks, the baby was suspected to have hydrops and was referred to Perinatal Center of Iowa.

Our assessment revealed an appropriately growing fetus with normal anatomy.

