ANOTHER CASE OF HDN WITH A NEGATIVE MATERNAL ANTIBODY SCREEN

ANSWERS

1. What do you think was the cause of this infant's hemolysis? Is this a typical case of this entity? Are there any other possibilities? (Hint: why was the additional maternal testing performed?)

   This infant appears to have ABO antibody mediated hemolytic disease of the newborn (HDN). Significant HDN due to maternal fetal ABO incompatibility is largely limited to group A and B infants of group O mothers, and among those, contributes to significant neonatal jaundice in only 10 to 20% of cases. The vast majority of these can be controlled with phototherapy alone, so it is rare for an infant with ABO-HDN to require exchange transfusion. Severe ABO HDN is more frequent in individuals of African ancestry.

   Another possible cause of severe HDN in this case is that the mother has an antibody against a low frequency antigen expressed by the father and the infant. A crossmatch between the mother's serum and the father's RBCs to evaluate this possibility (see the cases "Icterus Praecox" and "Erythroblastosis Fetalis Without and Obvious Cause" in this section of the case studies) cannot be done when there is ABO incompatibility between mother and father/neonate. In order to perform such a crossmatch the maternal ABO antibody would have to be adsorbed to completion which is a difficult procedure. Instead, we tested the mother's serum against cells bearing low frequency antigens. However, only a few such cells were available, and an antibody against a low frequency antigen remains a possibility, albeit unlikely.

2. What special preparation of the blood should be performed for an exchange transfusion? Why do you suppose a "double volume" exchange was not performed?

   The RBCs used in the exchange must be compatible with the mother's antibody which is why group O RBCs were selected. AB plasma was selected to be compatible with the infant's RBCs, but group A plasma could have been used as well. The RBCs were irradiated to prevent graft-versus-host disease. The RBCs selected were preserved in additive solution. There has historically been a concern regarding the adenine content of an entire additive solution unit, although the concern is largely a theoretical. Nonetheless, we express the anticoagulant-preservative from such units before pooling. The RBCs were also leukocyte filtered to reduce immunological consequences of transfusion. This reduces CMV transmission as well. Term infants are not at risk for severe consequences of CMV infection. Nonetheless, many blood banks would use CMV-seronegative RBCs for such a transfusion.

   Historically, exchange transfusion is performed with a volume of whole blood that is twice the infant's blood volume. In premature infants "double-volume exchange" can often be accomplished with a single unit of RBCs and plasma, and in some cases a single unit of whole blood can be used. In a large, term infant such as this one however, a double volume exchange would have required that the infant be exposed to 4 different donors rather than 2, and we have found that less than a double volume exchange typically achieve the desired goals.

3. Why did the bilirubin level rebound so quickly after the transfusion?

   Any form of exchange transfusion including whole blood exchange, RBC exchange, and plasma exchange can only remove substances that are within the vascular space. Therefore, exchange is relatively efficient for RBCs (100% intravascular) and IgM (85% intravascular), but less so for IgG (45% intravascular). Unconjugated bilirubin has a very large volume of distribution within the body, so as soon as the procedure is complete, bilirubin begins to re-equilibrate between the tissues and the blood, elevating the blood level. Thus the efficacy of exchange depends on its ability to replace incompatible RBCs and, to a lesser extent, on removal of maternal antibody. Ongoing phototherapy contributes to the control of the bilirubin level.