ABO...K? Investigating if young females need more than ABO-compatible blood

What is this research about?

Antigens are proteins, sugars and lipids on the surface of cells the immune system uses to distinguish its own cells, tissues and organs from those of another person. Antigens on the surface of red blood cells determine blood type and the most important blood group systems are ABO and Rh. ABO type is determined by the presence or absence of A and B antigens on the surface of red blood cells. People have antibodies against the ABO blood group antigen they lack on their own cells. For example, people with blood group O have anti-A and anti-B antibodies in their blood. These antibodies can recognize A and B antigens and tag the foreign cells for destruction. So transfusion of A, B, or AB red blood cells to a person with blood group O could lead to destruction of the transfused cells and cause a serious transfusion reaction. For all other antigens, including Rh antigens, people do not normally have antibodies in their blood. However, some people who have been exposed to the foreign antigen by transfusion or pregnancy may have these antibodies.

Within the Rh system, D is the most important antigen since a large percentage of individuals who do not have the D antigen (D negative blood types: A-, B-, AB- and O-) will become immunized (i.e. develop anti-D antibodies) when transfused with D positive blood (types A+, B+, AB+ and O+). These antibodies can then cause transfusion reactions if further D positive blood is given. The antibodies can also cross the placenta during pregnancy and cause destruction of fetal red blood cells if the baby has D positive blood. This condition is called hemolytic disease of the fetus and newborn (HDFN). For these reasons, all blood donors and recipients are typed for their ABO and RhD groups, and recipients receive blood that matches their blood type.

ABO and RhD are important but they are not the only red blood cell antigens. In fact, there are over 30 other blood groups systems made up of over 300 antigens on the surface of red blood cells. K (also called KEL1 or Kell) is one of these antigens. K is found in nine per cent of Caucasians and less commonly in other racial groups. Like RhD, people can be K positive (they have the K antigen) or negative (they lack the K antigen). If someone with K negative blood is exposed to the K antigen through transfusion with K positive blood, they can form anti-K antibodies. Woman with K negative blood can also develop anti-K antibodies because of pregnancy. These anti-K antibodies can cross the placenta and also cause HDFN. To reduce the risk of HDFN, in some countries women under the age of 45 are transfused with compatible blood based not just on ABO and RhD, but also on their K blood type. This is not standard practice in Canada or the United States. To understand if this practice should be considered in Canada, the rate of anti-K antibodies in pregnant women and the likely cause (i.e. previous transfusion or previous pregnancy) was investigated.

What did the researchers do?

Canadian Blood Services performs blood typing and red blood cell antigen testing for pregnant women in British Columbia, Alberta, Saskatchewan and Manitoba (in other provinces this testing is also conducted, but not by Canadian Blood Services). The researchers looked at results from tests conducted between January 1, 2011 and December 31, 2013 to see how common anti-K antibodies were. In Manitoba, the researchers also investigated whether women with anti-K antibodies had been previously transfused. They searched the Canadian Blood Services donor typing databases to see if the transfused blood was from a K positive or K negative donor. They also reviewed international standards regarding transfusion with K-matched blood.

In brief...

Matching for K-blood type when young females need blood transfusions may reduce the risk of hemolytic disease of the fetus and newborn.
What did the researchers find?
Anti-K antibodies were found in 397 out of 390,193 individual patients – a rate of 1.02 per 1,000 patients. Anti-K antibodies were the second most frequent antibodies found, and were found more frequently than anti-RhD antibodies. Of the 75 patients identified with anti-K antibodies in Manitoba, 26 (35%) had received transfusions in the province since 2001. Of these:

- 14 had received at least one K positive red blood cell unit
- 3 had received all K negative units
- 9 had received blood from donors whose K type was incomplete or unknown
- 8 had previous pregnancies, three of which were with K positive partners

Of the remaining 49 Manitoba-based patients with anti-K antibodies and no history of transfusion in the province (since 2001), 22 had previous pregnancies. In the majority of these cases, where the partner’s K type was known, the partner’s blood was K negative.

International practice varies. Use of matched or K negative blood for women under 45 with childbearing potential is standard in many European countries, including the United Kingdom, France, the Netherlands, Belgium and Germany.

How can you use this research?
This study shows a history of transfusion is a risk factor for developing anti-K antibodies. Of the patients in Manitoba who had anti-K antibodies, 35 per cent had received a transfusion in that province since 2001. This rate of transfusion is probably underestimated, as some people may have had transfusions in other jurisdictions or before 2001. Transfusion of women less than 45 years of age with K-matched blood reduces the incidence of HDFN due to a history of transfusion, as seen in the Netherlands, where this has been standard practice since 1993. Although several hospitals in Canada and the United States have begun using K-matched blood for younger females, it is not a requirement nor is it standard practice in Canada, the United States and Australia. Why? Chronically transfused patients (e.g. patients with cancer) can develop anti-K antibodies and may need K-matched blood. There are concerns that if K-matching for women younger than 45 is introduced there may not be enough K-matched blood for everyone who needs it. In the past it was not economical to test all blood donors for K-type. Today, testing technology has improved and now K blood type is known for 25 per cent of Canadian Blood Services donors – K blood type is automatically printed on the label of red blood cell units if typing has been performed on two donations from the donor. These improvements mean K matching is becoming increasingly possible. HDFN due to anti-K antibodies occurs in approximately 1 in 20,000 pregnancies. Providing K-matched blood to prevent anti-K antibodies from developing in younger females may be an effective way to reduce the incidence of HDFN in Canada and other countries that have yet to adopt this practice as standard.

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