



The Clinical Use of O Negative Red Blood Cells

Background

ABO compatibility of red cells is recognized as fundamental to a safe transfusion. Transfusion of red cells bearing A or B antigen that is regarded as “foreign” by the recipient invites a prompt, dangerous and potentially fatal hemolytic reaction because everyone has pre-existing antibodies in the ABO system to antigens lacking on their own red cells. When clinical circumstances do not allow time for determination of the patient’s ABO group, the only safe course of action is to select Group O red cells (which are considered universal donor for the ABO type) until the ABO type can be determined -- this usually takes only 5-10 minutes.

The Rh system is immunologically different. An Rh negative person will be at risk for having a hemolytic reaction only if they have been previously transfused with Rh positive blood or previously pregnant with Rh positive baby. If never exposed, an Rh negative person does not have this risk. Although the Rh (D) antigen and several other “minor” antigens are relatively good at inducing an immune response, only about 3 percent of the entire population has a “minor” antibody. Further, while transfusion of an antigen-positive unit into a recipient with the corresponding antibody may lead to a shorter circulatory half-life for those red cells it is highly unlikely to elicit an immediate physiologic response.

There is an additional consideration for women who may become pregnant. An alloimmunized mother’s fetus may suffer from erythroblastosis fetalis -- or hemolytic disease of the newborn -- since the red cell antibody can cross the placenta to the fetus. Because of this, special attention is directed to women of childbearing potential to reduce the risk of provoking alloimmunization, particularly in the Rh system.

The Challenge

If all units of red cells could be supplied as O Rh negative, many of the concerns noted above could be eliminated. However, only about 7 percent of the population in our donation area has an O Rh negative blood type. Transfusion of O Rh negative red cells to patients of other groups and types is occasionally necessary to protect females that may go on to have pregnancies. Using O Rh negative red cells for other transfusion recipients places an added strain on the blood supply and on the O negative donors who help support it. As well, this reduces the availability of O negative units for recipients who should or must receive only this type.

Currently, Puget Sound Blood Center collects 12 percent of red cell donations from O negative donors. These donors are especially generous with their time and subject to regular requests to donate as soon as they are eligible. As the blood donor population continues to age, and as more longtime donors move into the age range where they are increasingly likely to be transfusion recipients, the proportion of requested O negative blood type becomes unsustainable. This is placing extraordinary burden on O negative donors and creating a community-wide shortfall in this unique resource. Note that the difference between the use of O Rh negative red cells and their expected proportion amongst the 200,000 units collected annually by PSBC already amount to almost 10,000 units!

PSBC’s goal is to direct blood type selection to optimize the care of all patients while ensuring that each patient is receiving red cells that will provide safe transfusion.

Managing O-Negative Demand: Emergency Transfusion

One of the most frequent uses of O Rh negative red cells is in circumstances when emergency red cell transfusion is urgently needed but the patient's type is unknown. Should all such patients receive O Rh negative units?

Most facilities rely on protocols to direct O Rh negative red cells to those patients who will receive the greatest benefit from them. These include:

- Women of child-bearing potential: for this recipient group, the goal is to avoid alloimmunization that might complicate a future pregnancy. The applicable age varies by institution, but 45 or 50 years is the most common. (It may be instructive to determine the frequency at which women above a proposed cutoff age give birth in a hospital's catchment area.)
- Young males: some institutions include boys under 16 or 18 years in the group to receive O negative red cells if they have not been previously blood typed when their underlying condition (most likely a malignancy) is more likely to require future, long-term transfusion as part of their medical care.

When emergency transfusion is needed to a patient who does not have a "current" pre-transfusion type, PSBC recommends:

- O negative red cell units if the recipient is a female under the age of 50 years, or a male under the age of 18 years;
- O positive red cell units for all other patients; and
- Conversion to the patient's ABO and Rh type and type as soon as that can be determined.

Large Volume Transfusions

Occasionally, an O negative patient suffers large-volume blood loss and multiple units (more than six) are required to be transfused. Unless the patient is already alloimmunized (that is, has anti-D antibody) or is a female of child bearing potential, strong consideration should be given to converting the patient to receiving O positive red cells in the interests of conserving the O negative inventory for those who have need under the defined protocol. Even if the O negative patient ultimately makes anti-D --a response likely to take at least 3-4 months -- the patient is not at immediate risk of hemolysis. If sensitized (risk is approximately 20%), the patient would then receive O negative red cells in the future. Thus, the one-time use of O positive cells poses no immediate harm and little future risk to the patient.

Conserving O Negative Red Cell Resources Common Practice

The protocol defined above is commonly practiced in institutions both large and small across the country. In trauma situations, one of the largest and most prestigious emergency facilities on the east coast -- the Shock Trauma Unit at the University of Maryland -- widely promotes the approach of maintaining a stock of 10 O positive and 2 O negative red cell units for emergency use. (Dutton RP et al. J Trauma 2010;69:620-6; Dutton RP et al. J Trauma 2005;59:1445-9). The Shock Trauma Unit has concluded this approach to emergency transfusion yields excellent patient outcomes and is prudent resource management, with less than 10 percent of transfused units being O negative and a very low rate of Rh sensitization.

A similar practice is deployed at the University of Pittsburgh. In a follow-up analysis (Yazer MH, Triulzi DJ. Detection of anti-D in D- recipients transfused with D+ red blood cells. Transfusion 2007;47:2197-2201.), only about one in five Rh negative recipients of Rh positive red cells made anti-D, further limiting the long-term impact of transfusing Rh positive blood to an Rh negative recipient.

Harborview Medical Center also reserves O negative red cells as recommended above, and utilizes O positive red cells for all other emergency uncrossmatched untyped patients.

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