

# TRANSFUSION MEDICINE UPDATE



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## Emergency Transfusion: Uncrossmatched or Incompatible Blood

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**Introduction:** In the majority of patients for whom blood transfusion is requested, sufficient time is available to complete serological testing and identify crossmatch-compatible blood. In emergent situations, however, uncrossmatched blood may be released for transfusion, provided written authorization is obtained from the ordering physician, indicating that the clinical situation is such that the risk of delaying transfusion outweighs that of transfusing uncrossmatched, incompletely tested or serologically incompatible blood.

A number of circumstances may arise that require transfusion of blood that has not been crossmatched or is crossmatch-incompatible. Each is briefly discussed below.

**Emergency transfusion of uncrossmatched blood:** Emergency red blood cell transfusion before crossmatching and/or antibody screening has been completed is sometimes a clinical necessity. Clinical circumstances include: trauma, acute surgical blood loss and severe anemia from any cause. In such situations, group O red cells are transfused. Rh negative units are generally given to women below age 50, while Rh positive units are selected for males and older women. The immediate risk of transfusing uncrossmatched units stems from the possibility that the patient may have circulating RBC alloantibodies that can cause a hemolytic transfusion reaction. Acute hemolysis from such antibodies is uncommon and mostly confined to antibodies against A, B, I, Vel, Jk(a), Jk(b), PP1P<sup>K</sup>, Ge, and rare examples of anti-Le(a), anti-Le(b), Sc1, Lan, Jr<sup>a</sup>, and Co. Published papers suggest that the practice of transfusing uncrossmatched blood is generally safe.

Transfusion of Rh positive blood to Rh negative patients will result in anti-D formation in 20-50% of patients. In young women, after the patient becomes stable, RBC exchange with Rh

negative blood, followed by Rh immune globulin prophylaxis for prevention of Rh immunization may be considered.

**Warm autoantibody causing incompatibility with all crossmatched units:** In cases of warm autoantibodies, serological workup to exclude underlying RBC alloantibodies would normally be performed, but this can be time-consuming and a patient's clinical condition may not allow it to be completed prior to transfusion. In such cases, careful transfusion of type-specific blood that is negative for antigens against which the patient is known to have had antibodies should be undertaken. Warm autoantibody-incompatible RBCs are generally well tolerated as transfused donor RBCs and have a survival comparable to a patient's own RBCs. Once the serological work up has been completed, additional transfusions should include antigen negative RBC units if underlying alloantibodies are detected. Corticosteroid treatment is indicated to treat the underlying disorder. Although not the standard of care, intravenous immunoglobulin administration to achieve reticuloendothelial blockade may be considered.

**All crossmatches are incompatible:** This may be seen with an autoantibody or an alloantibody against a high frequency antigen. In either case, the strength of reactions with different cells is similar. If the strength varies, multiple alloantibodies should be suspected. Antibodies against some high frequency antigens (e.g. Yt<sup>a</sup>, Hy, Co<sup>a</sup>, Co<sup>b</sup>, Ge, Cr<sup>a</sup>, P, and At<sup>a</sup>) can cause a hemolytic transfusion reaction when antigen positive units are transfused, but others (Sd<sup>a</sup>, JMH, Ch, and Rg) generally do not. If time permits, antigen negative units can be obtained from the national system of frozen inventory of rare blood. When multiple alloantibodies are present, hemolytic potential of antibodies should be taken

into account to develop a strategy for selecting antigen positive units for transfusion. In this regard, Rh antibodies (e.g., D, C, E, c, and e), Kidd antibodies (e.g., Jk<sup>a</sup>, Jk<sup>b</sup>), Kell (e.g., K, k) and Duffy (e.g., Fy<sup>a</sup>, Fy<sup>b</sup>) appear to have greater hemolytic potential compared to others (e.g., Lu<sup>a</sup>, M, N, S, s, V, VS, Le<sup>a</sup>, and Le<sup>b</sup>).

**Alloantibodies of undefined specificity reacting at temperatures below 37°C:** Such "cold" antibodies are generally considered benign and units that are crossmatch-compatible at 37°C are selected for transfusion without further specific antigen typing.

**Alloantibodies of low affinity but high titer (HTLA):** These antibodies give weak reactions against a panel of cells, but weak reactions persist when serial dilutions of the sera are tested. HTLA antibodies show serological incompatibility, but are clinically benign.

**Massive transfusion in patients with RBC alloantibodies:** In patients with RBC alloantibodies needing surgeries that require a large amount of blood transfusion (e.g., liver transplant, thoraco-abdominal aneurysm repair), it may not be possible to find sufficient antigen-negative units to perform the surgery in the usual fashion. In such cases, 15 to 20 antigen-negative units are obtained for the surgery. These units are used for the first ten units, after which, antigen-positive units are transfused until near the end of the surgery, when antigen-negative units are again selected for transfusion. Following a 10-unit blood loss early in the case, the circulating antibody titer is decreased allowing transfusion of antigen-positive units to maintain oxygen carrying capacity without risking hemolysis during the remainder of the case. Switching back to antigen-negative units near the end of the case minimizes postoperative hemolysis, as the patient's alloantibody eventually returns.

**Conclusions:** In the difficult circumstances outlined above, the clinical picture of the patient should drive the decision as to whether or not to proceed with transfusion. Clinicians caring for these patients should not wait excessively for the blood bank to complete the serological work up or to find antigen-negative units, in order to avoid irreversible damage due to tissue hypoxia. Patients should be transfused before the

possibility for irreversible damage manifests itself. For instance, transfusions should not be withheld when it appears that oxygenation seems likely to require intubation and mechanical ventilation.

While the risk of transfusion in the circumstances described above is greater than transfusion of crossmatch-compatible blood, exact quantitation of this increased risk is not possible in emergent situations. Radio-isotope labeled RBC survival and monocyte monolayer assays are not widely available and are impractical in emergent situations. In non-emergent situations, a biological or in vivo crossmatch can be performed by transfusing 30 mL of serologically incompatible RBCs over 15 minutes, and then obtaining a sample and examining the plasma for visual hemolysis. Approximately 2.5 ml of incompatible blood hemolysis in an average adult will impart a red hue to plasma corresponding to a plasma hemoglobin of approximately 35 mg/dL. Lack of hemolysis suggests that a catastrophic hemolytic transfusion reaction is unlikely. However, shortened survival of the transfused RBCs may still occur.

Additionally, serological findings do not always predict post-transfusion RBC survival. In fact, strongly serologically incompatible RBCs may survive normally upon transfusion. Conversely, crossmatch-compatible transfusions may have shortened survival. Fatalities from hemolytic transfusion reactions are mostly seen when ABO incompatible blood is transfused in error. Fatalities can also occur with delayed hemolytic transfusion reactions following crossmatch-compatible transfusions. Because of these complexities, close communication between the clinicians caring for the patient, the hospital blood bank and the regional blood supplier is important.

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