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Risks of Transfusion: Infectious and Non-infectious

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INTRODUCTION

Transfusion safety is a constant concern in the practice of modern medicine. The vigilance of physicians and other healthcare providers to detect and report is of utmost importance. Despite the best efforts, transfusion of blood products still carries very real infectious and non-infectious risks.

INFECTIOUS RISK

Blood product transfusions may transmit bacterial, viral or parasitic infections. Improved donor selection and testing has made the blood supply in the United States extremely safe, yet not 100% free of infectious risk. Table-1 lists current infectious risk estimates.

Bacterial Contamination

On rare occasion, blood may be contaminated with minute levels of skin bacteria during blood collection. Risk of bacterial infection from transfusion of a contaminated blood product is higher in platelets as compared to red cell or plasma transfusion because platelets are stored at room temperature. Bacterial contamination affects about 1 in 1000 to 3000 units of platelets although sepsis from platelet transfusion is seen in about 1 in 100,000.

Hepatitis B & C

American Red Cross data suggests that about 1 in 205,000 transfusions results in transmission of hepatitis B, while roughly 1 in 2 million transfusions results in transmission of hepatitis C. More recent studies, however, suggest the risk may be lower than this.

Human Immunodeficiency Virus (HIV)

The incidence of transfusion-associated HIV transmission continues to decline. Recent data suggests that the risk of HIV transmission is currently 1 in 2,135,000 units transfused.

Chagas Disease

Chagas is caused by *Trypanosoma cruzi*, a protozoan parasite. Current estimates suggest that 1 in 25,000 blood donors are infected with *T. Cruzi*. With the growth in immigration from Latin America, Chagas

appears poised to become a growing problem in this country. Currently, blood donor testing for Chagas antibody is being implemented for prevention.

Emerging Infections: West Nile Virus

A large scale West Nile Virus (WNV) epidemic began in the US in 2002 which was followed by implementation of routine donor testing in 2003. Risk of transmitting WNV via transfusion was estimated at 1.5 per 1000 donations in 2002 and has decreased to 1 in 12 million since donor screening was implemented.

Other Viruses

Select herpes viruses, mainly cytomegalovirus (CMV) and Epstein-Barr virus (EBV) have long been known to be transmissible via transfusion. A significant degree of control of this outcome has been achieved through the use of CMV-seronegative and/or leukoreduced blood components for at risk patients. Influenza A (including the H1N1 variant) is a respiratory virus spread via droplets or direct contact. To date there have been no reported cases of transfusion-transmitted influenza.

Table-1: Current Risk of Infection from blood components (USA)

Agent	Risk
HIV-1/2	1 in 2.1 million
HCV	1 in 1.9 million
HBV	1 in 205,000-488,000
WNV	1 in 12 million
Bacteria in product	1 in 75,000 (apheresis platelets)

NON-INFECTIOUS RISK

With the decline in infectious disease risks, the non-infectious risks of transfusion are receiving increasing attention. These are listed in Table-2.

Transfusion-Related Acute Lung Injury (TRALI)

TRALI presents with respiratory distress during or within one to six hours after transfusion of blood products and is the leading cause of death from transfusion. In addition to hypoxia, patients exhibit bilateral pulmonary edema (non-cardiogenic). HLA and neutrophil antibodies in donor plasma have been implicated. Plasma obtained predominantly from male donors and screening of female plateletpheresis donors for HLA antibodies are being introduced for risk reduction. Approximately 1:5,000 units can cause TRALI.

Transfusion-Associated Circulatory Overload (TACO)

TACO occurs when the transfused volume or rate exceeds the ability of the patient's cardiovascular system to handle the additional workload. From 25 to 65 cases per 100,000 have been reported to hemovigilance programs. Dyspnea, hypoxia, elevated central venous pressure, rales and pulmonary edema may be present. An increase in brain natriuretic peptide (BNP) in the post-transfusion sample as compared to the pre-transfusion sample may provide laboratory support to the diagnosis. Symptoms may appear similar to TRALI and a major distinction is that TACO patients will benefit from adequate diuresis while TRALI patients do not.

Hemolysis of Incompatible Red Cells

Acute hemolytic transfusion reactions (1:38,000 units) typically occur in the setting of accidental transfusion of ABO incompatible red cells. There is significant risk of mortality in this setting. These reactions result from failure to properly identify the intended transfusion recipient either at the time of the initial phlebotomy for pre-transfusion testing or prior to administering the transfused product.

Allergic Reactions

Occurring in up to 1% of recipients, allergic reactions, mostly hives, pruritis, and flushing are most often secondary to recipient antibody versus donor plasma proteins.

Severe anaphylactoid or anaphylactic reactions are quite rare and may be due to anti IgA antibodies in IgA deficient patients.

Febrile Non-Hemolytic Transfusion Reactions

This common reaction is characterized by a ≥ 1 degree Celsius rise in temperature compared to pre-transfusion vitals in a non-premedicated patient. Differential diagnosis includes hemolytic, septic and TRALI reactions.

FATALITY DATA

During fiscal year 2008, the FDA reported 46 transfusion-related fatalities. Of these, 16 were attributed to TRALI, 10 to ABO-related acute hemolytic transfusion reactions (HTR), 7 to microbial infection, 7 to hemolytic transfusion reactions due to non-ABO red cell antibodies, 3 to TACO and 3 to anaphylaxis.

CONCLUSION

The infectious disease risks associated with transfusion have been reduced dramatically through improved techniques for selection and testing of blood donors, as well as, increasing focus on appropriate transfusion practices. Emerging infections in the US population, such as Chagas, Babesia, Malaria, human variant Creutzfeldt-Jakob disease (vCJD), dengue viruses and others remain of concern for the future. In addition, continued emphasis on non-infectious transfusion risks will help ensure continued patient safety in the future.

Table-2: Noninfectious Risks of Transfusion

Risk	Published Rates
Febrile nonhemolytic reaction	RBC: 1 per 100-500 units Platelets: 1-1.5%
Circulatory Overload (TACO)	1 per 100-2,000 units
TRALI	1 per 5,000
Allergic reaction, mild	1 per 4,000 RBC, 3-5% of platelets
Allergic reaction, severe (anaphylactic)	1 per 25,000 RBC, 1 per 2,000 platelets
Hemolysis of incompatible RBCs	1 per 13,000-200,000 1 per 1.3-1.7 million (fatal)

RESOURCES

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3. Dodd, R. Current risk for transfusion transmitted infections, Current Opinion in Hematology. 2007;14:671-676.
4. Emerging Infectious Disease Agents and their Potential Threat to Transfusion Safety. Transfusion, August 2009 special supplement.

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