

Editorial

Blood transfusion: is it safe for users?

Pusparini

Clinical Pathology Department, Medical Faculty, Trisakti University

Blood transfusion is a long-known life-saving procedure for patients in need of blood, as its history can be traced to about 200 years ago. The first successful blood transfusion performed from one human to another was pioneered by James Blundell, an obstetrician who in 1818 succeeded in transfusing 227 mL of blood to a patient with postpartum hemorrhage.⁽¹⁾

The modern practice of blood transfusion dates from the discovery of the ABO blood groups by Karl Landsteiner in 1901 and of the Rhesus blood group in 1940, in association with Wiener. The collection, storage, and banking of blood and the use of anticoagulants became a recognized procedure immediately after the end of World War I.⁽²⁾ Currently blood is packaged in sterile plastic bags with the addition of anticoagulants. It may be distributed as whole blood or in the form of blood products, such as packed red cells, frozen fresh plasma, platelet concentrates, and cryoprecipitates.⁽³⁾

Every minute there is one person in the world who needs blood and blood products. In all countries, surgery, trauma, severe anemia and complications of pregnancy are the clinical conditions where blood transfusions is necessary. The problem arising is that there are many patients who do not have access to blood when needed. It is estimated that worldwide only 80 million units of blood are donated each year. This particularly has its impact on women with complications of pregnancy, trauma victims, and children with life-threatening anemia.

Blood transfusion may be likened to a two-edged sword, because on the one hand blood transfusion is needed to save a person's life while on the other hand it can lead to side effects and complications ranging from the most mild to the most severe, i.e. death. Therefore the issue of safe blood transfusion is an urgent one. The World Health Organization (WHO) has issued guidelines for performing safe blood transfusion in every country. The WHO strategy for blood safety comprises: (i) a well-organized, nationally coordinated blood transfusion service that can provide adequate and timely supplies of safe blood for all patients in need; (ii) the collection of blood only from voluntary non-remunerated blood donors from low risk populations; (iii) testing of all donated blood for transfusion transmissible infections, blood grouping and compatibility testing; (iv) the appropriate clinical use of blood, including the use of alternatives to transfusion whenever possible and the safe administration of blood and blood products; (v) a quality control system covering all stages of the transfusion process.

With adequate donor selection among volunteers and screening of the blood for transfusion transmissible infections (TTI), the incidence of TTI can at present be reduced to extremely low rates. The transmission rate of hepatitis B has reportedly declined substantially, as has the transmission rate of syphilis. The transmission rate of hepatitis C has decreased by 90%, from

1 : 200 in the year 1990 to 1 : 3000 in 1992. It is currently predicted that the transmission rate of hepatitis C through blood transfusion will decrease to 1:103.000. In the past, the transmission of HIV as a result of transfusion was estimated to be between 5% and 10%, but in 1996 all branches of the PMI started to perform screening tests for HIV (human immunodeficiency virus). The current estimate of HIV transmission by transfusion is 1 : 676.000.⁽⁴⁾

In addition to the risk of TTI there are several noninfectious hazards of blood transfusion, resulting in considerable morbidity and mortality rates. The noninfectious hazards include hemolytic transfusion reactions, reactions associated with leukocytes and leukocyte antibodies, graft versus host disease, transfusion related acute lung injury dan mistransfusions.⁽⁶⁾

The majority of deaths are caused by acute hemolysis due to errors in identification of blood samples, blood components and the blood of recipients. In the last decade one in 38,000 units of red cells transfused in New York was the result of ABO incompatibility due to errors. Half of these errors took place outside the blood banks. In an international survey involving 62 hospitals, among 690,000 blood samples one in 165 was mislabelled or miscollected. It is said that in the United States the incidence of mislabeled and miscollected samples was 1000 to 10,000 times higher than the risk of TTI.⁽⁵⁾

Transfusion of blood fractions rich in leukocytes causes severe febrile reactions, whereas in transfusions with an identical number of units containing low levels of buffy coat cells no febrile reactions develop. The minimum numbers of leukocytes capable of inducing transfusion reactions vary from 0.25×10^9 to 25×10^9 and the degree of temperature increase is correlated with incompatible numbers of leukocytes and transfusion speeds. Transfusion reactions associated with leukocyte antibodies exhibit variable symptoms and signs, such as fever, dyspnea, hypotension, hypertension, and stiffness. The pathophysiology of leukocyte antibody reactions may be explained by the hypothesis that antibody binding of transfused leukocytes produces a monocyte-activating complex resulting in release of cytokines and their pyrogens. These transfusion reactions may be minimized by using leuko-depleted blood.⁽⁵⁾

Transfusion associated graft versus host disease (TA-GVHD) occurs when immunocompetent allogeneic lymphocytes in the transfused blood bind to the blood of the recipient, proliferate and attack host tissues. Recent reports mention rare but fatal events involving fetuses receiving exchange transfusions and children with immune disorders such as Wiskott-Aldridge syndrome and thymic aplasia. To date no TA-GVHD cases have been reported in patients with acquired immune deficiency syndrome (AIDS). TA-GVHD develops 4 to 30 days after transfusion of blood and blood products. The treatments of TA-GVHD range from difficult to useless. With the development of a full blown syndrome the mortality rate approaches 90%. What is needed for effecting a decline in TA-GVHD incidence is a pathogen reduction technology involving nucleic acids, to be applied in the production of future blood components.⁽⁷⁾

Another severe transfusion reaction is termed transfusion related acute lung injury (TRALI), previously called noncardiogenic pulmonary edema. TRALI is currently the most frequent cause of death due to transfusions as reported by the Food and Drug administration (FDA). TRALI is estimated to occur in 1:5000 blood transfusions, with a reported mortality of up to 15%. Several strategies have been formulated to prevent the development of TRALI, including avoiding the use of plasma containing human leukocyte antigens (HLA), minimizing the use of blood from female donors to reduce exposures to HLA and leukocyte antibodies that might have been induced in pregnancy.⁽⁸⁾ In conclusion, although blood transfusion cannot be said to be completely safe, the risk of transfusion reactions may be minimized by improvements in the blood bank management system, involving donor recruitment, TTI screening, and use of sophisticated technology.

REFERENCES

1. Blundell J. Experiment on the transfusion of blood by a syringe. *Med Chir Trans* 1818;9:56. Cited by PJ Schmidt, AG Leacock. Forgotten transfusion history: John Leacock of Barbados. *BMJ* 2002;325:1485-7.
2. Blundell J. A successful case of transfusion. *Lancet* 1829;1:431. Cited by en I. Hajdu SI. A note from history: blood transfusion from antiquity to the discovery of the Rh factor. *Annals Clinical Laboratory Science* 2003;33:471-3.
3. Mahmud Z. Are the blood transfusions safe! *JAFMC* 2009;5:1-2.
4. Improving blood safety worldwide (editorial). *The Lancet* 2007;370:361.
5. Alter HJ, Klein HG. The hazards of blood transfusion in historical perspective. *Blood* 2008;112:2617-25.
6. Dzik WH, Murphy MF, Andreu G. An International study of the performance of sample collection from patients. *Vox Sang* 2003;85:40-47.
7. Klein HG. Transfusion associated graft versus host disease: less fresh blood and more gray for an aging population. *Transfusion* 2006;46:878-80.
8. Kopko PM, Marshall CS, MacKenzie MR, Holland PV, Popovsky MA. Transfusion related acute lung injury:report of clinical look back investigation. *JAMA* 2002;287:1968-71.