BC PROVINCIAL Pediatric Oncology Hematology Network Newsletter

BC Cancer Agency CARE & RESEARCH An agency of the Provincial Health Services Authority

BC CHILDREN'S HOSPITAL An agency of the Provincial Health Services Authority

www.kidscancer.bc.ca Issue number 10 Winter 2008

Transfusion Practice in Pediatric Oncology/Hematology

Dr. Tim D. Prestidge
Pediatric Oncology/Hematology Fellow
BC Children's Hospital

Dr. Louis D. Wadsworth
Hematopathologist
Children's & Women's Health Centre

The judicious use of blood product support is an integral component in the effective care of the pediatric oncology/hematology patient population. It is generally a well tolerated and safe intervention but even so, each transfusion demands careful and deliberate consideration as to the potential harm and expected benefits. This article outlines the steps taken to ensure blood product safety in Canada, as well as the risks associated with transfusion with reference to the unique requirements of the pediatric oncology/hematology population. While this article will outline potential risks of transfusion it should be noted that Canadian blood remains among the safest in the world.

TRANSFUSION SAFETY

Transfusion safety in Canada is an integrated and comprehensive process that begins with donor recruitment and ends with monitoring and evaluation of the patient during and after transfusion. Transfusion system safety is paramount not only for the recipient but also for the donor.

Dr. Tim Prestidge and Dr. Louis Wadsworth

Safety of the blood product

Donor recruitment starts with the principle of voluntary donation with an altruistic motivation on the part of the donor. In Canada, blood donation is non-remunerated and voluntary, and we must encourage as many healthy persons as possible to give blood. This principle of voluntary blood donation removes financial motivation which could lead to inappropriate donor selection, and also protects the inherent and legal status of human tissue, keeping it free from pecuniary value. All potential donors are screened by review of previous donation records, a questionnaire, an interview, a physical examination and blood testing in order to defer volunteers with potentially unsafe blood and to protect those who may suffer injury as a result of the donation.

The collection and preparation of blood is subject to strict quality guidelines and can only be undertaken in approved facilities with appropriately trained staff. Safety for the recipient, the donor and collection staff is an essential aspect of this. Samples of each donation are tested individually or in small batches for a variety of infectious diseases. In Canada, these include syphilis, hepatitis B (HBV) and C (HCV) viruses, human immunodeficiency virus (HIV 1 and 2), human T-Cell lymphotrophic virus (HTLV) I and II and West Nile Virus (WNV). The blood group (ABO and Rhesus type) and the presence of blood group antibodies are also determined.

After collection and processing, blood products are stored in specially designed and strictly controlled refrigerators both in the Canadian Blood Services Blood Centre and subsequently in the hospital transfusion laboratory.

Safety of blood product delivery to a patient

The medical decision to transfuse or not is perhaps the most crucial point in safety of transfusion. It should be recognized that the risks outlined below are real and that transfusion is not a casual prescription but rather a measured intervention involving a potentially dangerous product. Each transfusion decision must be carefully weighed and considered in the best interest of the patient under the specific circumstances unique to that setting.

Blood transfusion has been likened to marriage: "...it should not be entered upon lightly, unadvisedly or wantonly or more often than is absolutely necessary." (Robert Beale).

Once the decision to proceed with transfusion has been made, the recipient must undergo testing to ensure that the correct blood products of the appropriate blood group are issued. Strict policies exist governing the collection and identification of patient samples. These minimize any possible error in the correct and safe matching of a recipient with a particular blood product.

Patient blood samples are tested for ABO group and Rhesus type as well as antibodies to foreign blood cells. Potentially dangerous antibodies can be found in patients who have previously

Continued on page 2

Continued from page 1...Transfusion Practice

been transfused. The formation of antibodies against foreign blood cells can occur soon after exposure to donor blood, which is why these tests need repeating 72 hours after transfusion. For some hematology patients who will receive numerous transfusions (eg. patients with thalassemia major) the blood will be tested for more than just ABO and Rhesus type to ensure that other blood groups are also tested.

Once this testing is complete, the issue and administration of blood is subject to further quality processes starting within the laboratory and ending with the ongoing monitoring and evaluation of the patient during and after the transfusion. These steps are governed by policies developed and monitored by the hospital transfusion committee. Central to this process is the need for informed consent prior to transfusion.

TRANSFUSION RISKS

The risks of transfusion are classically divided into infectious and non-infectious complications which are often of an immune nature.

Infectious Complications

Viral Infection

Viral infection resulting from transfusion is very rare, but nevertheless remains the subject of much interest. In Canada, the risks by viral type per blood unit transfused are as follows [1]:

HIV	1:4.7 million to 1:10 million
HCV	1:3.1 million
HBV	1:31,000 to 1:82,000
	Risk of clinical disease
	1:1.2 million
HTLV	Very rare

The risk of HIV is so remote that it has to be mathematically modeled. Hepatitis B remains the greatest viral risk but new testing modalities have been added in Canada to reduce this risk even more.

Bacterial Infection

Transfusion related bacterial infection is a long recognized complication which has come into sharper focus in recent years.

Bacteria may enter a blood product from the donor's skin, from damaged packaging, or from external contamination. Infected red cell units may be recognized by an intense purple colour. If transfused the recipient becomes extremely ill and death can result.

Canadian data reveals that 1 in 28,000 –143,000 red cells and 1 in 2,300-77,000 platelet units show evidence of bacterial contamination, platelets having the higher frequency because they are stored at room temperature and are suspended in plasma which encourage bacterial growth.

Other Infectious Risks

Malaria has been acquired via transfusion in Canada with an estimated risk of 1 per 400,000 to 4,000,000 transfusions. Rare diseases that represent more of a theoretical risk include Babesiosis, Chagas Disease, and variant Creutzfeldt-Jacob Disease (vCJD) (possible post-transfusion cases of vCJD have been reported in the UK where vCJD has been a major problem).

Immune Complications

Transfusion related immune complications typically occur at the time of transfusion or shortly afterwards. The common reactions include:

Febrile Non Hemolytic Transfusion Reactions (FNHTR)

FNHTR's have an incidence of between 1 in 650 to 1,000 transfusions. These mainly occur with red cells and platelets. They are caused by damage to the patient's or donor's white cells. Starting within 30 minutes of transfusion the patient feels cold, develops a fever and may start to shiver. Recurrent and severe FNHTR's can occur in multi-transfused patients.

Allergic Reactions

These are also common, occurring 1 in 100-200 transfusions. These are mild and typically cause hives. The patient is usually allergic to something in the donor blood. These reactions can be prevented by giving antihistamines before transfusion begins.

Anaphylactic Reactions

These occur 1 in 20,000 to 1 in 50,000 transfusions and cause widespread hives, asthma (wheezing) and shock. One fatality has been recorded.

Hemolytic Transfusion Reactions (HTRs) – acute or delayed

Acute HTRs are most commonly due to an ABO group mismatch. They occur in around 1 in 25,000 transfusions and may be fatal in 1 in 600,000 transfusions. The commonest cause of this reaction is a clerical error - either in specimen labeling, processing, unit labeling or administration - which underlines the importance of the special labeling requirements enforced for all transfusion related testing. Symptoms and signs range from anxiety, fever, chills, flushing, low back pain, pain in the line of the IV, hemoglobinuria (red urine), coagulation abnormalities, to severe shock and kidney failure.

There are other causes for hemoglobinuria. The blood cells may already be damaged at the time of transfusion. This may occur when the red cells are mixed with an incorrect fluid or medication or when the red cell units are frozen or overheated.

Delayed HTRs occur when a blood group antibody is undetectable prior to transfusion, but antibody levels rise rapidly after transfusion and destroy the transfused red cells. This occurs between 1 in 2,500 to 6,000 transfusions and typically causes jaundice (yellowing of the skin and eyes) a few days after transfusion. Hemoglobinuria and kidney failure can also occur but are rare. If a transfused patient becomes jaundiced some days after transfusion, the medical or nursing staff at the hospital MUST be informed.

Transfusion Related Acute Lung Injury (TRALI)

TRALI is now one of the most common severe risks of transfusion. The estimated frequency is around 1 in 5,000 transfusions but is less common in children than in adults. It is thought to be due to antibodies in the donor or recipient. These antibodies bind to the patient's white cells. The damaged cells lodge in the lung and cause tissue damage, chills, fever, breathlessness, cough and low blood pressure. These symptoms develop during or within 6 hours of completion of transfusion. TRALI can lead to severe respiratory distress and low blood oxygen levels. The symptoms usually clear in 24 hours but the patient may be very seriously ill and require admission to the intensive care unit. Rarely this condition may be fatal.

Continued on page 3

Continued from page 2...Transfusion Practice

Transfusion Associated Graft vs Host Disease (TA-GvHD)
This is caused by live donor white cells (present in small quantities in some blood products). These begin to grow and start to damage the patient. Oncology patients are most at risk. Symptoms and signs begin with skin rash extending from the trunk to extremities from day 4 to 30, fever from day 4 to 23, low blood counts from day 11 to 30, hepatitis and infections. Death typically occurs between day 12 and 65 after transfusion.

Even in patients with normal immune function, TA-GvHD can occur when the donor is closely related to the recipient. In these cases the recipient fails to destroy the donor white cells. This occurs most commonly when blood is received from a close family member.

Fortunately, TA-GvHD can be completely prevented by irradiation of cellular blood products.

CONCLUSION

At present the greatest serious and potentially fatal risks of blood transfusion are getting the wrong blood product, TRALI and bacterial contamination. The risk of viral disease transmission (such as HIV or hepatitis) is vanishingly rare. The most important step in transfusion safety is avoiding unnecessary transfusion. Informed consent prior to blood transfusion remains an important part of the transfusion process.

REFERENCE

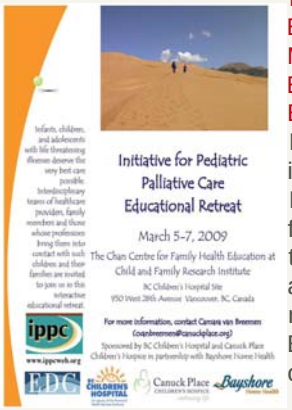
[1]Physician's Guide for Blood and Blood Product Utilization. BC Provincial Blood Coordinating Office. 2004.

RECOMMENDED READING

Bloody Easy 2: Blood Transfusions, Blood Alternatives and Transfusion Reactions - a Guide to Transfusion Medicine. J.L. Callum and P.H. Pinkerton. Sunnybrook and Women's College Health Sciences Centre. Canada.

EDUCATIONAL OPPORTUNITIES

Chemotherapy Course for Pediatric Nurses in Community Hospitals
February 4-6, 2009
BC Children's Hospital
For more information contact Grace Chan (gchan@cw.bc.ca, 604-875-2345 ext 7435).



Initiative for Pediatric Palliative Care Educational Retreat
March 5-7, 2009, The Chan Centre for Family Health Education at Child and Family Research Institute, BC Children's Hospital
Infants, children, and adolescents with life threatening illnesses deserve the very best care possible. Interdisciplinary teams of health care providers, family members and those whose professions bring them into contact with such children and their families are invited to join us in this interactive educational retreat. For more information, contact Camara van Breemen (cvanbreemen@canuckplace.org). Register online at http://edreg.cw.bc.ca/phsaedcalendar/

COG/APHON Collaborative Nursing Workshop
"Saving the 'My Space' Generation: Why Age Matters"
March 10-11, 2009, Dallas, Texas
Workshop for pediatric and general (adult) oncology nurses and allied health care practitioners who are interested in transition issues and barriers to care in the AYA population. Registration at www.aphon.org

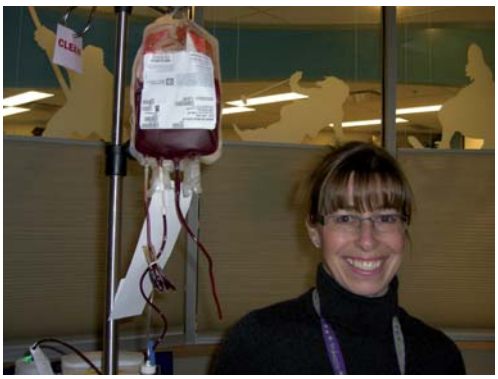
"Welcome Back"
Facilitating the School Experience for Childhood Cancer Survivors
A workshop, sponsored by the Leukemia and Lymphoma Society of Canada (www.lls.org/wes), to educate school personnel on the cognitive and late effects of childhood cancer treatment and to improve the transition of childhood cancer survivors from clinic to classroom. If you are interested in holding a workshop in your community, contact Sharon Paulse, Patient Services Manager (604-733-2873 ext 3, sharon.paulse@LLS.org)

Return Undeliverable Canadian Addresses to
BC Children's Hospital
Provincial Pediatric Oncology/Hematology Network
Attn: Grace Chan, Network Coordinator
Room A119, 4480 Oak Street
Vancouver, BC V6H 3V4

Publications Mail Agreement No. 41074013

What Happens When There is a Suspected Transfusion Reaction?

Marion Nelson, RN
Transfusion Safety and Resource Nurse Clinician
Children's & Women's Health Centre



At BC Children's Hospital (BCCH), we have been involved in centralized provincial reporting of transfusion reactions since 2001. BCCH sees approximately 100 transfusion reactions a year. Eighty percent of these reactions occur in the oncology setting. Transfusion safety and reaction reporting has been included into the developing role of the Transfusion Safety and Resource Nurse Clinician.

When a transfusion reaction is suspected, it is evaluated at the bedside by the nurses and physicians involved. Guidelines and information are available on the BCCH intranet (Transfusion Policies and Procedures). This web site is helpful in assisting with the clinical decisions that have to be made at that time. Once the transfusion reaction is recognized and steps have been taken to ensure patient stability and safety, a transfusion reaction report form is filled out.

The transfusion reaction report form asks for dates, times, symptoms, product and patient information. The form and, if necessary, the remaining product are sent to the Transfusion Medicine Lab. This initiates a transfusion reaction investigation. A lab worksheet is filled out with a clerical check, visual inspection and a DAT (Direct Antiglobulin Test). A chart review is often done by the Transfusion Safety and Resource Nurse to gather more information if necessary to assist the hematopathologist with his/her conclusion.

Chart reviews also provide an opportunity to monitor protocol, ensuring transfusion policies and procedures have been followed. Often this can lead to on-the-spot learning opportunities for nurses and physicians or can trigger an area that needs some group education by the nursing and physician educators.

When a transfusion reaction investigation is complete, i.e. signed off by the hematopathologist with the conclusion and any comments or recommendations, it is then sent to the Provincial Blood Coordinating Office (PBCO). The PBCO is responsible for compiling this data for the province of British Columbia.

BCCH is fortunate to have a system in place for transfusion reaction reporting along with excellent transfusion resources for nurses and doctors. Transfusion reactions, minor to life threatening, do happen probably more frequently than realized and are likely under reported.

The Provincial Pediatric Oncology/Hematology Network

The Network is an interdisciplinary organization whose goal is to ensure appropriate diagnosis, management, follow-up, and end-of-life care for pediatric patients with malignancies and blood disorders.
The Network supports community hospitals and practitioners, and develops partnerships with other health care facilities to enable seamless and integrated care for patients and families on treatment and off treatment.
It will further develop and enhance the research programs of basic, translational, and clinical research to better childhood cancer control and improve outcomes for these patients and their families.

For More Information

To learn more about the Provincial Pediatric Oncology/Hematology Network, or to submit articles or stories to this newsletter, please contact:

Grace Chan
Network Coordinator
604-875-2345 ext 7435
gchan@cw.bc.ca

Dr. Chris Fryer
Network Clinical Consultant
604-875-2345 ext 6884
cfryer@cw.bc.ca

Steering Committee Chairs

Dr. Paul Rogers
604-875-2345 ext 7839
progers@cw.bc.ca

Barbara Poole
604-675-8000 ext 7999
bpoole@bccancer.bc.ca

www.pedsoncologyeducation.com

This website is an excellent educational resource for health care professionals in pediatric oncology care. The content and information on the website are provided by the oncologists and staff at BC Children's Hospital and BC Cancer Agency.