What is a Blood Management Program?

Susan Bator, M.D.
Medical Director of Blood Bank, Lancaster General Health
and
Mary Bassalin, BS, RN, CCRN
Transfusion Safety Specialist

INTRODUCTION

A Blood Management Program is an evidence-based approach to optimize safety and quality of patient care through the appropriate use of blood products. The objective is accomplished by a coordinated effort in which education, data collection, feedback, monitoring of patient outcomes, and attention to anemia early, are major components. This objective is accomplished by optimizing the patient's own blood volume (especially red cell mass), minimizing the patient's blood loss, and assessing the patient's tolerance for anemia before considering any transfusion.

There are now approximately 100 hospital-based blood management programs in the United States. Another 100 to 200 hospitals, including Lancaster General, are in the process of developing blood management programs. Moreover, blood management has become a hot topic in the blood banking and transfusion medicine community, and with the Joint Commission.

RISKS OF BLOOD TRANSFUSION

Physicians and other patient care givers have long been aware of various risks associated with blood transfusions. These include transmission of infectious diseases, allergic reactions, and fluid overload. More recently, transfusion related acute lung injury (TRALI) and unique infectious disease risks such as West Nile Virus, Chagas disease, new variant Jakob Creutzfeldt disease, and Babesiosis have caused concern. With more sophisticated testing we have reduced the risks substantially for many known infectious diseases, but there is always concern about the risk of a new, unexpected infectious disease.

Delivery of oxygen is the most important function of blood, and its capacity to do so is determined by hemoglobin level, cardiac output, and arterial oxygen pressure. Increasing the number of red cells does not always increase oxygenation as it can increase viscosity and decrease cardiac output, thus limiting oxygen delivery. Also, because of the non-linear oxygen dissociation curve, delivery of oxygen to the tissues is greater with a lower hematocrit. Nitrous oxide (NO) depletion is another negative factor associated with blood transfusion because of its importance in the regulation of blood flow and activation of endothelium-relaxing factor (EDRF). Stored blood has increased red cell microparticles and cell free hemoglobin, which scavenge NO and activate platelets. As a result, EDRF is not activated; instead of vasodilation that enhances blood flow to the tissues, vasoconstriction occurs and tissue perfusion is decreased.[1]

Recent literature focuses on the immunomodulatory effects of blood transfusion, which is actually a liquid transplant. Because it affects the immune system, transfusion has been associated with increases in the risks of hospital acquired infections, general morbidity, length of stay, and mortality. As a result the medical literature has recently been flooded with reports that more restrictive use of blood products is better for patients. Studies supporting this concept have been reported in orthopedics,[2,3] cardiothoracic surgery,[4-7] trauma, gastrointestinal bleeding,[8-10] ICCU patients,[11] and many other fields of medicine.

BALANCING RISKS AND BENEFITS OF BLOOD TRANSFUSION

In contrast to the above, coexisting literature has stressed the importance of treating anemic patients, since they do worse than non-anemic patients after surgical procedures. There is a higher risk of short and long term mortality, increased risk for renal and heart failure, and an increased readmission rate.[12,13] Still, because of the aforementioned risks, blood transfusions are not always the right answer for anemic surgical patients. The preferred answer is to use early treatment of anemia in order to get the patient's hemoglobin into the normal range before an elective operation. Often patients are known to be anemic well before their scheduled surgery, yet the issue is not addressed because it is assumed that it can be treated at the time of surgery. Moreover, in addition to bolstering the hemoglobin directly, the source of the anemia

should be considered, including possible nutritional deficiencies. Preoperative assessment should include iron and other vitamins, as well as the possible need for IV iron or erythropoietic agents.

There is a clear benefit to transfusion in some patients, and most would agree that transfusion of red cells is indicated for a patient with a hemoglobin of 6 or less. Most would also agree that a transfusion of red cells to a patient with a hemoglobin of 12 or greater is not indicated. It is the patients in between those extremes who have been addressed in the literature. It is important to look at your patient and not just the numbers.

The American Association of Blood Banks (AABB) offers the following guidance:[14]

1. For hospitalized, stable patients, adhere to a restrictive transfusion strategy (hemoglobin of 7 to 8 g/dl)
2. For hospitalized patients with preexisting cardiovascular disease, adhere to a restrictive transfusion strategy, but consider transfusion for patients with symptoms or a hemoglobin level of 8 g/dl or less.
3. For hospitalized, hemodynamically stable patients with the acute coronary syndrome, the AABB does not recommend a liberal or restrictive transfusion threshold.
4. In general, transfusion decisions should be influenced by symptoms as well as by hemoglobin concentration.

The Joint Commission made recommendations[15] in November 2010 in regard to blood management for:

1. Consent for transfusion;
2. Indication for transfusion (RBC, plasma, and platelets);
3. Documentation of blood administration;
4. Preoperative screening for anemia;
5. Preoperative testing for blood type and screening for antibodies.

The Society of Thoracic Surgeons, The American Society of Anesthesiology, and The Society of Critical Care Management have also published guidelines that adopt a conservative use of blood products.

PRACTICAL ASPECTS OF A BLOOD MANAGEMENT PROGRAM

Blood management programs are diverse[16] but all have a multifaceted approach that includes:

1. Management of preoperative anemia;
2. Management of perioperative blood use;
3. Strategies for ICU and post operative management;
4. Review of Blood Utilization through auditing;
5. Changes in physicians' and nurses' behavior.

Management of preoperative anemia basically means correcting the anemia before admitting the patient for surgery. Anemia can be managed in a pre-surgical clinic or one dedicated to anemia, or by the surgeon or primary care giver.

Management of perioperative blood use includes use of cell savers; normovolemic hemodilution; surgical techniques that minimize blood loss; tranexamic acid to decrease bleeding in orthopedic operations; thromboelastography to tailor the use of blood products; and a policy of restrictive use of blood products.

Strategies for ICU and post operative management include minimizing blood draws, collection of blood from drainage sites for reinfusion, and point-of-care testing. The average ICU patient has 41 ml. of blood drawn for testing each day and 95% of patients in the ICU for three or more days are anemic. Almost 50% of these patients receive an average of 5 units of packed red cells during their stay in the ICU.[17]

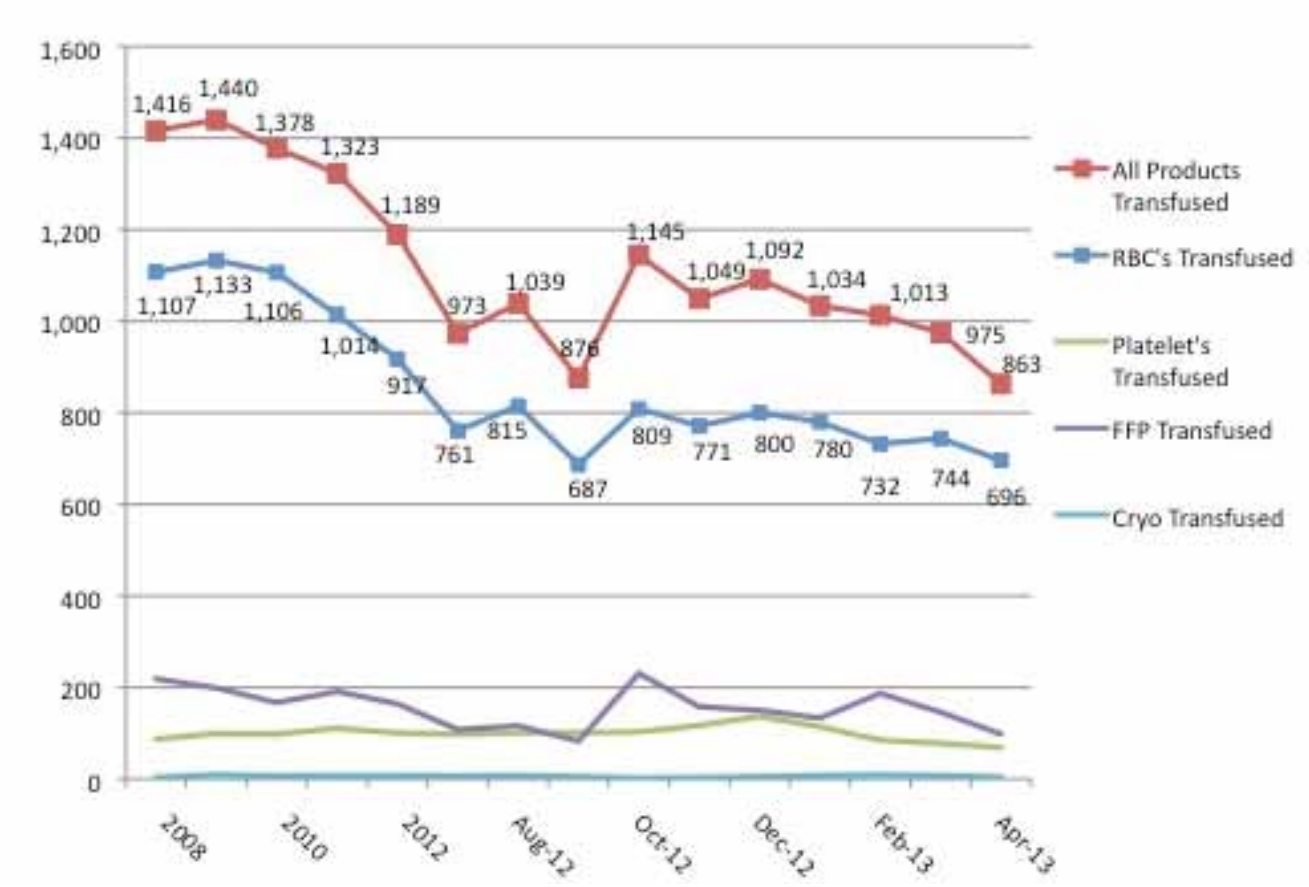
Reviews of Blood Utilization should be timely if retrospective, and prospective if possible.

Changes in physicians' and nurses' behavior occurs basically through education and review of recent literature in their specific field of practice. Data collection is a critical component of this process. It is important to compare blood usage amongst peer groups within an institution as well as to develop a larger data base that includes data from multiple hospitals and physician groups nationwide. Much of the recent progress in reducing blood transfusions in Orthopedic surgery has been the result of reviewing recent studies in the orthopedic literature (FOCUS study2), education of orthopedic physician leaders, and studies that compare blood usage with similar services at other institutions.

BLOOD MANAGEMENT AT LGH

Concentrated efforts in blood management began at LGH in 2011 when Dr. John Yelcick, Medical Director of Laboratories, began a series of presentations to staff regarding the risks associated with blood product transfusions. Publications in the *Journal of Lancaster General Hospital*[18] and *Progress Notes* then followed. At that time, we began to see significant decreases in our rates of transfusion (See Table I). The most notable decrease has come in orthopedics and

Table 1: Overview of Transfused Products at LGH



with the use of the FOCUS study, staff education, physician scorecard development, and benchmarking, transfusion rates decreased for hip replacements and knee replacements from 22.9% and 18.4% respectively in FY 2011, to 10% combined in FY 2013 thus far.

Bloodless surgery programs are also becoming more common in order to respect the needs of patients who refuse blood products for religious reasons or other preference. There is local interest in setting up a bloodless surgery program at LG Health. Established bloodless surgery programs offer all types of operations including neurosurgical procedures, bone marrow transplants, cardiac and vascular surgery, bariatric surgery, obstetrical services, treatment of traumatic injuries (lacerated livers or spleens) and many more. Dr. Patricia Ford at the Joan Karnell Cancer Center at Pennsylvania Hospital has performed over 100 successful bloodless stem cell transplants. These programs incorporate support from physicians, nursing, bloodless surgery care coordinators, nutritional services, social services, and pastoral care.

As our Blood Management Program at LGH moves forward, our goal is to improve patient safety by ensuring that the right patient is getting the right blood product in the right amount at the right time. We have a Transfusion Safety Specialist, Mary Bassalin, who has made inroads with many physicians and nurses since she assumed this role in July, 2012. We have a long way to go, but the seeds have been planted.

REFERENCES

1. Gladwin M. Potential Mechanisms for the Storage Lesion: Role of Hemolysis and Vascular Dysfunction. Presented at the SABM Annual Meeting , September 2012. Pittsburgh, PA.
2. Carson JL et al. Liberal or restrictive transfusion in high risk patients after hip surgery. NEJM. Online publication 12/14/11.
3. Goodnough LT et al. Detection, evaluation and management of preoperative anaemia in the elective orthopaedic surgical patient. NATA guidelines. British J Anaesth 2011; 106 (1): 13-22
4. Weber et al. Point of care testing: a prospective randomized clinical trial of efficacy in coagulopathic cardiac surgery patients. Perioperative Medicine 117 (3): 531-547.
5. The Society of Thoracic Surgeon Blood Conservation Guideline Task Force. Ann Thor Surg. 2011; 91: 944-982.
6. Loor G et al. Nadir hematocrit during cardiopulmonary bypass: end organ dysfunction and mortality. J Thor CV Surg 2012; 144: 654-662.
7. Bhaskar B et al. Impact of blood product transfusion on short and long term survival after cardiac surgery: more evidence. Ann Thor Surg 2012; 94: 460-467.
8. Villanueva C et al. Transfusion strategies for acute upper gastrointestinal bleeding. N Eng J Med. 2013; 368 (1): 11-21.
9. L. Laine. Blood transfusion for gastrointestinal bleeding. Editorial N Eng J Med 2013; 368 (1): 75-76.
10. Gever J. GI bleed survival with few transfusions. Med Page Today, Jan 2, 2013.
11. Vincent JL and Yalavatti G. Transfusion practice in the ICU: When to transfuse. Indian J of Crit Care Med 2003; 7: 237-241.
12. Shander A et al. What is really dangerous: anaemia or transfusion? Brit J of Anaesth. 2011; 107 (51): 141-159.
13. Goodnough LT et al. Detection, evaluation and management of anemia in the elective surgical patient. Anesth and Analg. 2005; 101 (6): 1858-1861.
14. Carson JL et al. Red blood cell transfusion: a clinical practice guideline from the AABB. Ann Int Med. March 26, 2012 published online: 1-2 (quote).
15. Tolich DJ et al. Blood management: best practice transfusion strategies. Nursing, January 2013: 41-47.
16. Alexander L. A look at five elements involved in a PBM program. AABB News, May 2012: 6-12.
17. Collins, TA. Packed red blood cell transfusions in critically ill patients. Critical Care Nurse. February 2011; 31: 25-33.
18. Bator SM. Blood Transfusion: Friend and Foe. J Lanc Gen Hosp. Winter 2011; 6: 107-113

Susan M. Bator, MD
Medical Director of Blood Bank
Lancaster General Health
555 North Duke Street
Lancaster, PA 17604
Phone 717-544-4307
Email: SMBator@lghealth.org

Mary Bassalin, BS, RN, CCRN
Transfusion Safety Specialist
Lancaster General Health
555 North Duke Street
Lancaster, PA 17604
Phone 717-544-8194
Email: mabassal@lghealth.org