PAS platelets

Febrile, non-hemolytic transfusion reactions (FNHTR) in the older literature of transfusion medicine included a number of events associated with blood transfusion that involved the development of patient symptoms, often quite severe but without evidence of hemolysis, in as many as 2–3% of blood component recipients. These were often ascribed to white cell antibodies, and indeed the use of leukocyte-reduced red cells did tend to decrease the observed occurrence rate in most hospitals. We know, of course, that some of these reactions are due to various plasma products/proteins. Many, if not most, are allergic in nature, manifesting as urticaria, or more severely, anaphylaxis. These allergic transfusion reactions (ATRs) are usually the result of a preformed IgE molecule in the recipient reacting to/with the corresponding allergen in the donor plasma. The leukocyte reactions are thought to be due to cytokines released into the plasma of the collected blood product during storage; thus, reduction of the plasma volume of these products, including platelet products, should—and does—have some effect upon ATR rates.

Reducing the plasma volume transfused is fairly easily accomplished in the case of red cells, and indeed almost all red cell concentrates distributed these days by our blood banks are suspended in additive solution and leukoreduced by filtration at the time of, or shortly after, collection. Volume reduction and/or washing of leukoreduced platelet concentrates reduces some types of transfusion reactions but tends to reduce significantly the number of platelets in the unit. Enter platelet additive solutions (PAS)!

The journal Transfusion has two interesting articles in this regard, one comparing large numbers of PAS-suspended and regular apheresis platelet transfusions in a single large hospital, some of them being compared as transfusions to the same patient; the other a large, multi-institutional study involving 14,000 platelet transfusions at six large hospitals in the midwest and east of the country. Both are non-randomized, retrospective studies, but their size enhances their power (see references).

Dr. Tobian and others from the Johns Hopkins University Hospital, along with colleagues from the American Red Cross and Case Western Reserve University, evaluated all ATRs occurring over a defined period of 6 months at the Johns Hopkins Hospital. There were 3,884 non-PAS AP transfusions and 1,194 that were PAS APs. Allergic reactions, ATRs, were characterized by itching, an urticarial rash/hives (usually not accompanied by fever) up to and including anaphylactoid

In the news

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Cover photo: 3D representation of human blood flow.

This issue of PLUS was written by Dr. Robert (Bob) Westphal.
A larger, multi-institutional study can also be found in Transfusion. The study looked not at platelet count increments but primarily at adverse reaction rates. Specifically, they compared leukocyte-reduced APs stored in Intersol (a brand of PAS 3, which have 65% less plasma than the standard) to the regular APs, which are stored in 100% plasma. This study involved 14,005 platelet transfusions from six major study sites in Minnesota, New York City and Long Island. Patients were transfused with whichever of the two products was available at the hospital at the time. No selection was made based on prior reactions or prior transfusion product.

The total number of adverse reactions in the 14,005 transfusions was 158, a rate of 1.13%. By group, the rates were 23/4,160 in the PAS group, 0.55%; and, 135/9,845, 1.37%, in the standard AP group. Allergic transfusion reactions (ATRs) occurred twice as often as FNHTRs in both groups, and the two types accounted for almost all of the adverse reactions in both groups. In pediatric patients the overall reaction rate was much less, but standard APs seemed to occur 9 times more frequently. No transfusions in any arm of the study led to death from a reaction.

Thus, it seems pretty clear that allergenic proteins and the cytokines in WBCs, or left in the plasma by expired WBCs, are responsible for the majority of adverse reactions to apheresis platelet transfusion. In addition, there are fewer units in PAS 3 APs that have high titers of isohemagglutinins. In a previous study, estimates were made that reducing ATR rates would save between $9 and $11 for each ATR. What is not known at this point is whether the system would save money overall by using all PAS plateletphereses. Those costs will certainly be examined. Patient preference should also be measured, as this is less easily assessed in financial terms.


Testing for platelet antibodies

Immunologic destruction of platelets can lead to very serious consequences, including death, in adults and children alike. It wasn’t too long ago that we had no idea how complex some of these conditions really were, and their complexity only became revealed with the development of our understanding about human platelet antigens (HPA) and their inheritance. Their presence was suspected when efforts using anti-HLA antibodies failed to detect many platelet-related alloantibodies. Autoantibodies against platelets (ITP or AITP) occur in a wide variety of immunologic conditions, but alloantibodies turn out to be of great clinical importance, occurring in such conditions as fetal and neonatal alloimmune thrombocytopenia (FNAIT), post-transfusion purpura (PTP) and non-HLA-related refractoriness to platelet transfusions. There are several available techniques for detection of these alloantibodies, including platelet immunofluorescence, monoclonal antibody immobilization of platelet antigens (the MAIPA test), and a variety of solid-phase immunologic assays that use platelet specific glycoproteins. Of these, the MAIPA test is considered the most specific and most sensitive method for detecting platelet alloantibodies. It is a difficult, complex test that takes 6–8 hours and requires the use of HPA-typed platelets, meaning that it can only be done in very specialized reference laboratories.

The authors of this paper, from the Netherlands and from a reagent company in Wisconsin, compared a recently developed bead-based platelet antibody detection method called PAKLx with the MAIPA test, currently recognized as noted above for its sensitivity and specificity. This new assay uses beads coupled to platelet lysate glycoproteins with the relevant HPA or Class I HLA antibodies. They tested sera with no platelet-reactive antibodies and sera with antibodies to HPA-1a, -1b, -2a, -2b, -3a, -5a and -5b antibodies, for a total of 194 samples at various degrees of titration. Some of these samples contained HLA-antibodies, glycoprotein antibodies, platelet autoantibodies and also no platelet-reactive antibodies. These were tested in both MAIPA and PAKLx assays, which showed comparable levels of sensitivity. Ninety-three percent of the samples were in agreement by both methods. In 5% of the samples the PAKLx test found antibodies not detected by the MAIPA method. The PAKLx method showed 4 false negative results out of 67 sera with HPA or GP-reactive antibodies (6%). A different assay, the LMX for detection of Class I HLA antibodies, was also compared to the PAKLx test, since MAIPA is not routinely used for HLA antibody detection. In testing of the 194 sera, 175 had well-defined HLA antibodies, in addition to assortments of the others. Comparing the LMX method showed 4 discrepant results, 3 being positive by LMX and negative by PAKLx and 1 negative to LMX and positive by PAKLx.

The PAKLx test takes about 3 hours to perform, doesn’t require typed donor platelets or monoclonal antibodies and uses only 10 μl of serum for screening and identification. The authors see these as major advantages when compared to the MAIPA test, and unlike MAIPA the PAKLx system can be used as a good screening test for HLA as well as HPA-specific antibodies. Because non-specific reactions may be encountered in the PAKLx test in cases with weakly reactive antibodies or broadly reactive antibodies, confirmation with MAIPA should be performed. However, PAKLx is an easy to perform sensitive method for screening for platelet alloantibodies.

Keeping bugs out of transfused platelets

Despite efforts to the contrary, contamination of platelet concentrates prior to transfusion has continued to be a problem and various means of addressing it have been developed. Nonetheless, the estimated frequency of contamination at the time of transfusion varies between 1 per 1,000 to 1 per 3,000 units. Although not every contaminant leads to death (FDA still reports 2–3 per year), patients who are so affected are almost always already quite ill from major bone marrow and/or immune dysfunction. Additional complications are unwanted, expensive and a great burden to our patients as well as to the hospital staff. Gram negative sepsis, in particular, is a great concern in such people. Current detection methods have constraints related to small inoculae at the time of collection, long waiting periods for detectable growth and what is usually an urgent demand for the product. Ideally, a reliable test performed just prior to transfusion would be of great use to all.

Two different approaches to this were outlined in Transfusion in June (see references). One involves a rapid colorimetric test that is already approved for rapid detection of platelet bacterial contamination, the BacTx test. The authors inoculated leukoreduced apheresis platelet concentrates and leukoreduced pools of platelet concentrates from 6 units of whole blood. Only 1 of the 6 concentrates in the pools was inoculated. The inocula contained 8 aerobic and 2 anaerobic strains representing Gram negative and Gram positive species (see paper for details) in concentrations from $1 \times 10^3$ CFUs/ml to $8 \times 10^4$ CFUs/ml. Neither of the 2 anaerobic species grew in any of the concentrates or in culture plates. Tests were positive for inocula sizes from $6.2 \times 10^4$ to $7.6 \times 10^4$ CFUs/ml, which is clearly below the bacterial load of $>10^5$ CFUs reported to be associated with septic transfusion reactions.

The test can be performed in less than 1 hour and measures absorbance of a red chromogen at 500 nm. Reagents and equipment are relatively simple and familiar, and the test is FDA licensed for this use. Using multiple lots of test analytes and a variety of technical operators, the authors report that specificity was high (99.8%) and there was only one invalid run in a total of 937 tests. The authors are recommending it as an auxiliary test to be used prior to transfusion at 3 or more days of room temperature incubation.

A newer approach, but one that is complex and still in the development stage, involves lysis of the platelets in suspension. This technically leaves bacteria intact and is followed by adding a synthetic DNA substrate to the now-available bacterial DNA polymerase after a second lytic step, that of beadmill-induced microbial lysis. During subsequent incubation, the bacterial DNA-polymerase modifies the synthetic DNA substrate which can then be detected by quantitative polymerase chain reaction (PCR). The authors, from ZEUS Scientific in New Jersey and St. Luke’s Hospital in Bethlehem, Pa., carried out experiments on platelet concentrates spiked to various concentrations with standard cultures of various bacteria, incubated then tested them over a range of 1–7 days. The method detected bacteria at an approximate sensitivity of 30–200 CFUs per ml. It did so within 48 hours for 6 of the 7 initial test bacteria, except for the traditionally slow-growing S. epidermidis, which took 6 days. Subsequently, they tested 22 relevant bacterial strains and demonstrated similar sensitivity.

The method is novel, and seemingly complex. The authors found the test required about 2 hrs to complete for 6 samples, 90 minutes of which involved 2 incubation steps. They are now focusing on ways to simplify the process and/or find ways to automate it. This range of sensitivity would make it a welcome addition, but at unknown cost, as yet. Both of these tests were discussed in the context of point-of-issue tests for bacterial contamination, and have not yet been approved by the FDA otherwise would be in addition to the current method(s) in use.


An international look at bacterial testing of platelets

Published reports on the detection of bacterial contamination in platelet concentrates illustrate wide variations in methods used and in outcomes. Therefore, it is a difficult topic to look at in broad perspective, since there are so many possible variations in findings. Two reviewers, one from the Medical Office of the American Red Cross Biomedical Services and the other from the National Bacteriology Laboratory of the British National Health Service’s Blood and Transplant Institute, London, have published a very thorough analysis/review of the English language literature that assesses the use of the BacT/ALERT system for platelet testing in use in many places worldwide. They found a total of 16 reports in each of which more than 10,000 platelet concentrates had been studied.

Not surprisingly, a large number of variations in practices and in outcomes occur. Such things as the method for and equipment type for collecting and/or pooling platelets, the method and effectiveness of skin preparation, whether or not initial steps included diversion of the earliest part of the sample following venipuncture, the volume of the product that is cultured, the time delay before sampling, inoculation procedures and types of culture obtained all had actual or potential impacts on the results. Not all reports had details on their procedures that allows for accurate comparisons to others.

Initial positive cultures ranged up to just over 1%, confirmed positives from about 0.01 to 0.1%. False negatives as determined by culturing products at outdate were higher, 0.07 to 0.22%. Septic reactions in patients ranged from 0 per 1 million to 66 per 1 million transfused collections. The authors discuss these in detail and use this information to make recommendations to platelet manufacturers to reassess the adequacy of their BacT/ALERT screening protocols in light of this international experience and carefully document all variable details when reporting results, and they propose a standardized framework for doing so.


Can you believe platelet counts for making transfusion decisions?

Another paper to talk about from the Biomedical Excellence for Safer Transfusion (BEST) collaborative comes to us from colleagues in Spain, The Netherlands, Canada and Vermont in the United States. The authors note that platelet transfusion therapy continues to be the mainstay of the treatment of patients suffering from quantitative and qualitative platelet disorders. In 2009, about 2.8 million platelet transfusions were performed in Europe and the USA, and the most frequent indication for transfusion was for prophylaxis and/or treatment of bleeding in hematology and oncology patients with bone marrow suppression from therapy for their underlying malignancy.

Automated analyzers have basically replaced the old method of manually counting platelets with a hemocytometer and a phase contrast microscope. However, the authors state that the method recommended by the International Council for Standardization in Hematology (ICSH) is based on an indirect platelet count. This method involves the counting of specifically labelled platelets relative to the red blood cells in the sample.
with a fluorescence flow cytometer, along with an accurate RBC count using a single channel particle encounter. However, the BEST group has developed a method that is more accurately applied to such low platelet samples, using fluorescent beads in a flow cytometer as the reference. At low platelet counts some investigators have found overestimates of the total in 67% of specimens, with coefficients of variation as high as 43%.

The authors prepared a standard sample of leukodepleted whole blood and added buffy coat residues to adjust the total platelet count to 50,000/μL (50 x 10⁹/L). This standard was then divided into 4 lots for counting platelets, 5 x 10⁹/L, 10 x 10⁹/L, 20 x 10⁹/L and 50 x 10⁹/L and labeled as L1, L2, L3, and L4 respectively. Antibiotics were added, the lots all partially fixated, packaged in standard vacutainer tubes and distributed to 69 participating sites in institutions in Europe and North America. From these, 82 sets of results were reported, using a total of 26 different instruments from a total of 6 manufacturers, from 9 different countries. All of these were using hematology analyzers, not the BEST method mentioned above. The results from the lot with 50 x 10⁹ platelets (L4) were pretty good, as one might expect, with a coefficient of variation (CV) from 0.8 to 11.0%. But the other 3 samples tested didn’t fare as well. L3 had a CV of 0.6 to 44.7%, Lot 2, 1.9 to 41% and the lowest, Lot 1, was 1.9 to 65.6%. Reported counts in the lots ranged from 44.5–90 (L4), 10–60 (L3), 10.8–48 (L2), and 2–56.6 (L1), all x 10⁹/L.

Looking at the results based on the assumption that patients with platelet counts < 10 x 10⁹/L should be transfused, under-transfusion of about 25% of them would have occurred, perhaps fatally so. At a threshold of 20 x 10⁹/L, under-transfusion would have occurred for 7% of the L1 group and 16% of the L2 group and over-transfusion for the L3 group. Clearly, these results from well-established laboratories in Europe and North America could affect the outcomes of platelet concentrate transfusions in the patient population. Would duplicate sample runs have helped, or would they in any of our hospitals? From these data, one can’t tell. But, trusting platelet transfusion decision-making to one simple count clearly is not the right choice about 1 time in 4. Given current equipment and practices, it may be the best we can do, but it also points out the importance of being very familiar with your patient if you’re the person making these decisions.

The former dean of the UCLA College of Medicine, Dr. Donald Tappley, wrote many years ago: “The importance of paying conscientious and meticulous attention to the patient cannot be overemphasized. Without it intelligence is wasted, factual knowledge is worthless, reasoned judgment is impossible, honesty is irrelevant and compassion is fraudulent.”

Some news on sickle cell disease

Many of you have had some experience in caring for patients with sickle cell disease (SSD), and are aware that some people have—especially in comparison to other SSD patients—a relatively mild degree of problems, despite having the genes for SS hemoglobin. And likely you are aware that there’s a lot more to severe SSD than just anemia. The anemia is characterized by a hemolytic anemia profile, with increases in LDH, indirect bilirubin, an increased reticulocyte count (except in aplastic crises) and a decrease in serum haptoglobin. Sickled cells are usually present on the peripheral blood smear. Some patients in this category have severe sickle cell phenotype with Hgb S/B thalassemia.

Patients with SSD are homozygous for an abnormal form of hemoglobin (Hgb) in which glutamic acid/glutamate is replaced by valine in the 6th amino acid position near the N-terminal end of the hemoglobin molecule. The amino acid substitution in that position renders the heme pocket unable to recover from deoxygenation by unfolding the molecule and letting O₂ re-attach, after giving it up in the capillaries. This leads to development of rigid RBCs with deposition of insoluble deoxy-Hgb S molecules, sickle formation, hemolysis and entrapment in small blood vessels, especially in the spleen, lungs and small distal capillaries, such as the feet and shins.

But the pathophysiology of SSD involves more than just what happens to the red cell. There is a great deal of clinical heterogeneity in people with SSD, and even in one patient over time. So the simple theory of microvascular occlusion as the cause of all the pathology in SSD does not account for all the problems, though the ones due to that are indeed many. SSD can be seen as a chronic inflammatory state with acute increases in inflammation wherein the vascular endothelium, WBCs, platelets, coagulation proteins, adhesion molecules and disruption of nitric oxide (NO) metabolism all participate. No single intervention serves to reverse all these factors. Oxygen therapy helps; transfusions help, but cause long-term problems; antibiotic treatment helps; treatment with the chemotherapeutic agent hydroxyurea helps—in some patients—due to increases in Hgb F which clings to and yet delivers O₂ better than Hgbs S, A, etc. Bone marrow transplant with “traditional” ablation/destruction of the original marrow has had some success in 400–500 children worldwide, but the results in adults have been much worse, primarily due to the toxicity effected by myeloablation, drug and/or radiation-induced destruction of the patient’s bone marrow. Transplantation without prior ablation of the original marrow has been attempted in adults but graft rejection and graft vs. host disease remain as significant problems.

The authors, primarily from sections of the National Institutes of Health, Bethesda, Md., explored a nonmyeloablative approach to promote T-cell tolerance in the recipients by the use of alemtuzumab (a monoclonal antibody that binds to receptors on B and T lymphocytes and is used to treat B cell leukemias/lymphomas), total body low dose radiation, and rapamycin (an inhibitor of certain growth factors). This regimen has fewer toxic effects, allows for stable mixed-donor chimerism and has been shown to help reverse the SSD phenotype.

This group carefully accumulated a group of 30 adult 16–65 year-old SSD patients over 9 years, patients with severe
symptoms over a long period. After preparation, they received mobilized peripheral stem cells from an HLA-matched sibling. The primary end point was treatment success 1 year after transplant, defined as a full donor-type hemoglobin for pure SSD patients and independence from transfusion in those sickle cell/B thalassemia patients. Secondary end points involved levels of donor leukocyte chimerism, incidence of acute or chronic graft vs. host (GVH) disease, immunologic recovery, changes in organ function and SSD-free survival.

Twenty-nine patients survived a median 3.4 years (range, 1–8.6) with no non-relapse mortality. One died from intracranial hemorrhage after a relapse. As of the end of last year (2013) 26 patients had stable, long-term donor engraftment without any acute or chronic GVH disease. Engrafted patients showed no evidence of hemolysis and had normal Hgb levels. Organ perfusion and function were greatly improved, and patients even tolerated phlebotomy to reduce hepatic iron. Weekly intake of morphine decreased considerably.

This is, admittedly, a relatively small number of patients who required a large amount of difficult and expensive treatment in these Phase 1 and 2 studies. As the authors point out, further monitoring of this group and the accrual of more patients into the study are required to further assess outcomes, adverse events and transplant tolerance. Nonetheless, this work is very important for development of improved approaches to the treatment (cure?) of SSD, and amelioration of the misery so many patients face over many years.


Sometimes no blood is the best transfusion decision

Severe liver disease is usually accompanied by significant changes in a number of hemostatic variables, and this fact has led to our attempting to intervene prophylactically when such patients are bleeding or faced with surgery. But, generally speaking, our routine laboratory tests are not reliably predictive of just what’s wrong, what the bleeding risks are, and what’s needed to prevent them. In fact, many preventive therapies are more likely to contribute to bleeding, not to prevent it. These facts and the insights stemming from them have brought about a reduction in the use of blood products in patients undergoing liver transplantation, and many such centers report increasing numbers of transfusion-free liver transplants. This means that other patients with severe liver disease who are to undergo an invasive procedure might not need, in fact might do better NOT to receive, the prophylactic products we have previously relied upon.

The authors of this article, from the Netherlands (see reference), review the hemostatic profile of patients with liver disease, and how such hemostasis is rebalanced. The liver plays a central role in the synthesis of just about all of the circulating coagulation factors, and also of the inhibitors of coagulation. It also makes thrombopoietin, the major hormonal stimulator of megakaryocytes in the bone marrow to manufacture mature platelets. The source of Factor VIII and of von Willebrand factor (VWF) is the vascular endothelium, including that of liver vessels, and vWF tends to be elevated, possibly due to the fact that the hepatic cells also clear vWF from the plasma. Since considerable Factor VIII is carried complexed with vWF, Factor VIII levels measured in the plasma also tend to be increased. All the other coagulation factors are decreased. Many such patients also have portal hypertension and splenomegaly, which may lead to some platelet sequestration. Thus, routine laboratory tests like the prothrombin time (PT), its standardized international normalized ratio (INR) and the activated partial thromboplastin time (aPTT) are quite frequently prolonged. Some patients with chronic liver disease may have accelerated fibrinolysis (although there is some doubt about this), whereas patients with acute liver failure present with laboratory features of inhibited fibrinolysis.
Since the PT and aPTT were developed simply to measure the individual procoagulant proteins, and to evaluate patients taking Vitamin K antagonists such as Coumadin, they are insensitive to the anticoagulant proteins in the blood, such as Proteins C and S, antithrombin, and the tissue factor inhibitor pathway. The anticoagulant proteins are not regularly measured, but they are also depressed, such that hemostasis is rebalanced. (See “Yin, Yang and Blood Clotting” in the Spring 2014 edition of PLUS.) We have classically been taught that severe liver disease was associated with a bleeding tendency, simply because we are used to measuring only fibrinogen levels, PT and aPTT. Indeed, spontaneous bleeding does occur, but is most generally associated with portal hypertension and bleeding from esophageal varices. There are major increases in both central venous pressure and splanchnic venous pressure, and therefore “preventive” treatment with large doses of FFP and platelets is more likely to initiate spontaneous hemorrhage than to prevent it.

Other means of testing the status of the hemostatic system exist, but are more complex and not in general use. The thrombin generation test (TGT) measures the total amount of thrombin generated during in vitro coagulation, not just the time it takes to form a clot like the PT and aPTT. Normally, about 5% of available thrombin is generated in the measurement, and in liver disease the rate of thrombin generation is normal to increased. The test has been modified with thrombomodulin, an endothelial cell receptor that is required for activation of the Protein C system. This modified test is sensitive to activity of all the factors in the anticoagulant part of the hemostatic system. Thromboelastography, using whole blood coagulation in a tube in which a small rod is attached to a measuring device while the tube is rotated, quantifies the several aspects of blood coagulation over time and records it. It can be used to identify a number of defects, including the rate of thrombin generation, hyperfibrinolysis, anticoagulant, and procoagulant defects. This test also requires special equipment and is not found in most general hospital labs. It has, however, been developed as a point-of-care technical instrument, and can be used by a trained operator right next to the OR; this allows for close monitoring, timely information and timely intervention, if needed.

There is a wealth of useful information in this article, and a neat summary diagram of treatment plans during the pre-procedural, intra-procedural and post-procedural phases for patients with liver disease undergoing an invasive procedure. The authors elaborate on the following points: bleeding does occur frequently, but is mostly hemodynamic in origin; thrombosis occurs frequently and may be underreported; and, blood transfusion is potentially harmful and may not help in preventing bleeding.

(Readers are also referred to the Fall 2012 issue of PLUS, which was devoted entirely to several papers on the proper use of plasma products and fibrinolysis inhibitors, such as tranexamic acid.)

As many of you recognize, once physicians have obtained their degree and are busy in practice, teaching, or research, it can be hard to capture enough of a group’s attention to change behavior, concerning transfusion medicine (TM) or most anything else, especially if it is not a prime factor in their regular practice. Enter Best Practice Alerts (BPAs) for physicians that “pop up” when they enter an order for transfusion products in the computerized hospital system. Some might describe it as the “Big Brother” method of changing behavior, but it certainly warrants a close look.

The authors, from Stanford University Hospital in California (see reference), analyzed blood utilization and ordering practices after implementing what they call real-time clinical decision support, or CDS, for short. Reasons for developing better blood management have included the known and unknown risks of transfusion, a need to better preserve and utilize blood products as a national resource, and a need to reduce the ever-increasing costs of hospital and medical care. It used to be the risks of transfusion reactions and transfusion-transmitted infections that drove these ideas, especially with unknown risks of infectious disease transmission related to Creutzfeldt-Jakob disease, West Nile virus, dengue, T. cruzi, leishmaniasis and other infectious agents. This category came to include concerns about increases in morbidity and mortality related to blood storage “lesions.” More recently it seems that costs and availability have an increased weight in transfusion decisions. Thus was born the concept of patient blood management, agreed-upon guidelines concerning indications for transfusion, point-of-care laboratory testing, preoperative iron therapy and other strategies. Improved blood utilization and improved patient safety have been linked as accreditation goals by the Joint Commission on Hospital Accreditation, who have added patient blood management indicators to their process. The authors linked best practice alerts (BPAs again) to blood product ordering.

First they developed a blood utilization clinical effectiveness team, using members of the hospital’s Department of Quality and Information Technology. Members of the team included key clinical services and constituencies: medicine, surgery, critical care, the operating room, trauma and emergency services, and transfusion medicine. They reviewed the evidence-based literature on indications for blood transfusion and developed consensus among the medical and surgical services for including real-time CDS to improve blood use. The intervention (BPA) consisted of an interruptive alert at the time of entry of the order, and the alert was designed so as to be triggered for an order that was outside the guideline established for red blood cells. In other words, if the agreed criteria were met (see next paragraph) no alert occurred.

The criteria for red cell transfusions were a Hgb less than or equal to 7 gm/dl in a stable, non-bleeding patient or 8 gm/dl in patients with acute coronary syndromes or post cardiac surgery. They also stated that single unit transfusions were usually preferable, which would have been heretical not long ago. Patients in the OR, or patients receiving blood for hemorrhage or bleeding, were excluded. At baseline, the number of patients who were given blood who had a Hgb >8 gm/dl ranged from 57–66% in 2008 to 2009. Other interventions by the clinical effectiveness unit from 2009 to 2010 decreased this significantly to a range of 52–56%. After implementation of the RBC guideline intervention, the percentage of “outlying” transfusions decreased to 35% and since has remained below 30%. The estimated cost savings for RBCs in 2009 compared to that cost in 2012 was $1,616,750. The use of clinical decision support with informational alerts that incorporate agreed upon, evidence-based information appears to improve blood utilization. Some might say: “Well, if you get ’em by their computers, their hearts and minds will follow.” But it’s likely true that we all increasingly recognize that there may be better ways to do many things, including transfusing blood products.

In addition to providing blood and blood services, the American Red Cross is pleased to offer its hospitals additional, specialized services such as continuing education (the SUCCESS® program), specialty publications (e.g., The Compendium of Transfusion Practice Guidelines) and reimbursement resources. These services are all offered at no cost to you. Please visit redcrossblood.org/hospitals and explore the offerings today.

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