

MAINTAINING SAFETY • REDUCING RISK

A New Look at Blood Transfusion

Evaluation of the risks and benefits prompts careful blood management

During the past decade, perceptions about the role of blood transfusion in medicine have begun to change. Several studies have shown that blood transfusion—commonly regarded as unproblematic—actually presents many serious risks to patient safety. At the same time, caregivers have begun to understand that widely used practice standards may result in many transfusions that are medically unnecessary. Conversely, growing blood supply shortages are endangering patients for whom transfusion is vital.

These facts are driving health care organizations toward an important realization: Implementing improved blood management strategies is essential to ensuring safe patient care.

Better Understanding of Risks

Pradeep Chandra, M.D., F.A.C.P., is chairman of the department of medicine and director of hematology and oncology at Wyckoff Heights Medical Center in Brooklyn, New York, and professor of clinical medicine at Weill Medical College of Cornell University. Joseph Thomas, R.N., is the director of the Center for Advanced Blood Management at Fairview, Lakewood, and Lutheran Hospitals within the Cleveland Clinic Health System. Both Chandra and Thomas say blood transfusion presents several health risks to patients, including the following:

Immune suppression—“It is not well appreciated that blood transfusion causes significant immunosuppression,”

Chandra says. “A blood transfusion is a liquid tissue transplant, but because it is blood, people do not look at it in the same way as a kidney transplant.” Thomas says this effect (known as *transfusion-related immunomodulation*, or TRIM) occurs every time a patient receives blood.

Reaction—Blood transfusions can cause several types of allergic and nonallergic reactions. Although they are not usually fatal, these events can extend a patient’s length of stay. One potentially deadly nonallergic reaction is *transfusion-related acute lung injury* (TRALI), which can cause respiratory failure. “At first it was thought that TRALI affected 1 patient in 10,000,” Thomas says. “Now it appears it might be 1 in 2,000 or less.”

Infection—Another underestimated risk of blood transfusion is the threat of transmitting infectious diseases, especially viral infections. “Even though blood banks have vigorous programs for ensuring that blood is not infected, many viruses cannot be detected in the early stage of infection,” Chandra says.

Risk of error—The leading cause of death from transfusion is error resulting in the administration of incompatible blood. “According to some estimates, a unit of blood passes through as many as 17 different pairs of hands between the time it is donated to the time it is administered to a patient,” Thomas says.

Emerging threats—One of the most disturbing dimensions of blood use is the threat of emerging pathogens in the blood supply. Variant Creutzfeldt-Jakob disease, for example, can be

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transmitted through blood from donors who are symptom free. “We need to be aware that when we transfuse a patient, it could be a life-saving therapy or, honestly, a carrier of death,” says Thomas.

For some more recent studies that demonstrate a link between blood transfusion and adverse patient outcomes, see the sidebar on page 12 in the online version of this issue.

A More Realistic View of Benefits

While researchers and caregivers are developing a better understanding of the safety risks of blood transfusion, they are also gaining a more realistic view of its necessity and benefits.

Chandra says recent advances in the understanding of anemia have led researchers to look more closely at which patients actually need blood transfusion. “The trigger for transfusion of packed red blood cells is generally considered to be a hemoglobin concentration of 10 grams per deciliter (g/dL),” he says. “What we are finding is that the need for transfusion should be dependent on the patient’s need for oxygen.” If a patient shows no signs of hypoxia (for example, increased heart rate, chest pain), then he or she does not necessarily need to receive blood products. The practical result is that many patients who currently receive blood could safely do without.

Research is also casting light on the therapeutic limitations of blood transfusion, says Damon Keeley, CEO of Hemo Concepts, Inc., which helps hospitals develop integrated blood conservation programs. Keeley says several studies show that stored blood provides less clinical benefit than many people realize. “Refrigerated, banked blood loses its ability to deliver oxygen in a short period of time,” he says. Banked blood may even contribute to inadequate blood flow; research has demonstrated the role of cold-stored blood in depleting nitric oxide, an important substance for maintaining blood vessel dilation.¹

Beyond clinical issues, experts also are looking at the impact of blood use on health care organizations and the health care system as a whole. Thomas notes that the cost of blood has soared in recent years. “Conservative estimates put the cost of transfusing a unit of blood between \$500 and \$700,” he says. “Some researchers put the total cost, including risks and complications, at more than \$1,000 per unit.” Most of that cost is not recaptured because Medicare does not reimburse the first three units of blood a patient receives in a calendar year. “In our experience, more than 50% of all blood is those first one, two, or three units—for a larger hospital, this could represent millions of dollars.”

Framing the entire issue is the fact that blood is in ever-shorter supply. An American Hospital Association survey

revealed that 57% of hospitals in the United States experienced blood shortages in 2001. Effects included canceled surgeries and ambulance diversions. “For most hospitals, blood shortages typically last less than a week, but 11% had shortages that lasted for more than a month.”²

The growing need to conserve blood resources—along with greater awareness of blood’s risks, limitations, and costs—is leading health care organizations to adopt a slate of strategies for reducing blood use.

Strategies and Tools

Keeley says the key to success in blood management is full organizational integration. “Every hospital uses a number of blood management methodologies—some in the ER, some on the floor—and each one reduces blood use somewhat,” he says. “However, when you implement every strategy across the organization, you get an exponential benefit.”

Clinical experts say effective blood management includes several complementary strategies:

- **Reduction of the transfusion trigger.** One of the most important tactics of blood conservation is to adopt an evidence-based approach to the patient’s need for allogenic blood. As noted previously, the common “10-gram rule” should be examined carefully. “We are taking care of a patient, not just a number,” Chandra says.
- **Increase in the patient’s blood production.** Using synthetic hormones to stimulate red cell production and increase hemoglobin concentration can help reduce the need for blood transfusion. Hip replacement patients at Wyckoff Heights Medical Center receive weekly injections of erythropoietin for three weeks before surgery. “We have done this with about 70 patients so far, and not a single one required blood,” Chandra says. (Increasing a patient’s red cell count can increase his or her blood pressure and risk of clotting; special management may be required.)
- **Iron replacement therapy.** Another technique for increasing patient blood count is iron replacement. This strategy can be used for both elective surgical patients and those experiencing acute blood loss. “We are aggressive with iron replacement therapy, often using IV iron when clinically appropriate,” Thomas says. “This may include some cases of severe anemia due to blood loss or chronic iron deficiency.”
- **Intraoperative cell salvage.** Cell saver devices collect and recycle a patient’s blood during surgery, reducing the need for an allogenic transfusion. Thomas says this tactic is most useful during major procedures. Chandra

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points out that the effectiveness of cell saver technology can depend on the skills of the person using it.

- **Clotting medications.** Several medications support clotting, which can reduce blood loss during surgery. Common options include antifibrinolytics and factor VIIa.
- **Acute normovolemic hemodilution (ANH).** Immediately before surgery, caregivers can draw whole blood from the patient to reserve and simultaneously replace it with fluid. The benefits of ANH are twofold: During the procedure, the patient bleeds diluted blood, and after surgery, the patient's own blood is transfused as needed.

One technique not included in this list is preoperative autologous donation—patients pre-donating blood for their own surgeries. Although this technique can reduce the chance of a patient receiving allogenic blood, it suffers from the limitations of using cold-stored blood. In addition, Chandra points out, the process itself is vulnerable to human error.

Implementing Blood Conservation Techniques

To develop a blood management program, health care organizations need to focus on more than just pharmaceuticals, technology, and surgical technique. “When I talk to people about blood management, they expect I will be talking about some magic medicine or tool,” Thomas says. “What surprises them is when I say the greatest single strategy for blood management is *education*.”

Thomas says educational efforts should target every caregiver who has an impact on blood use decisions. This includes not only surgeons but anesthesiologists, internists, attending physicians, and residents. He also says it is important to reach nurses: “When nurses understand the issues and the risks, they can become great advocates for appropriate blood use.”

The starting point is educating physicians on appropriate transfusion indicators. Thomas recommends setting clear guidelines by focusing on evidence-based literature and providing consistent follow-up. “Educating physicians on blood use needs to be a day-in, day-out effort,” he says. “It is important to get in front of physicians on a frequent basis—at committee meetings, through grand rounds speakers, and one-on-one.” At the Cleveland Clinic's Fairview Hospital, program leaders tracked blood use data and used it to identify providers who were not following guidelines. “We would then speak with those physicians and give them additional education,” Thomas says. “One focus was helping them tolerate lower hemoglobin levels in clinically stable patients.”

Even though longstanding habits can be hard to break, Chandra finds that surgeons, anesthesiologists, and other physicians are open to new approaches when they are educated about the risks and side effects of blood transfusion. Thomas says one key is presentation. “We found that the ‘blood management’ theme seems to win approval from physicians more than ‘bloodless medicine,’ which is really kind of a misnomer,” he says. “If you want to be embraced as a standard of care, you need to be more accurate.”

Keeley says one of the keys to integrating blood management into a health care organization is establishing strong clinical leadership. Leaders should include a nurse, a program director, key physician champions, and an ad hoc committee.

Both Chandra and Thomas believe the best way to introduce blood management to a hospital is one department at a time. “Orthopedics is a great place to start because it is an elective surgical population,” Thomas says. Depending on the situation, it may make sense to apply blood management strategies on a trial basis with a selection of patients. Tracking outcomes and demonstrating success is essential to winning acceptance. Chandra says one key to encouraging blood management throughout an organization is active involvement from the clinical laboratory: “The blood bank needs to take greater control of who gets blood.”

Added Benefits of a Blood Management Program

For health care organizations, reducing blood use can lead to significant financial benefits. Thomas says a hospital can easily save 10% to 20% on blood costs by implementing a blood management program.

“At Fairview Hospital, the orthopedics department achieved a 70% reduction in blood use. Cardiac surgery attained a 50% reduction. For the department of surgery overall, the reduction was 60%,” Thomas says. “We correlate this to a cost savings of more than \$500,000 per year.”

An indispensable resource for achieving this kind of success is patient involvement. Fairview Hospital educated the public on the advantages of blood management through its community publications, and Thomas says the effort has led directly to increased patient volume. (See page 12 of the online version for examples of these community publications.)

Keeley believes the key is making sure patients know that blood management is an option. “One of the most important parts of any program is providing information to patients on admission and giving them the opportunity to participate.” **PS**

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Sidebar. Studies Show Dangers of Blood Transfusion

Several recent studies demonstrate a link between blood transfusion and adverse patient outcomes:

- **Postsurgical complication.** A study of nearly 12,000 coronary bypass patients at the Cleveland Clinic showed that red blood cell transfusion is the single largest risk factor in postsurgical illness and death. Transfused patients have a risk-adjusted increased risk of kidney failure (106% higher), prolonged ventilator support (79%), serious infection (76%), cardiac complications (55%), and neurological events (37%). Risk of death is 77% higher. The study also showed that the risk of adverse outcome increases with each unit of red cells transfused.¹
- **Wound healing and length of stay.** An observational study at University Hospital in Maastricht, The Netherlands, showed that hip replacement patients who received allogenic blood transfusions were more likely to develop wound healing disturbances than nontransfused patients (31% versus 18%), significantly increasing length of stay (12.3 versus 9.8 days).²
- **Cancer survival.** A study of 130 patients with cervical cancer at the University of Arkansas for Medical Sciences, Little Rock, Arkansas, showed that blood transfusion could increase mortality risk. The results suggest that routine blood transfusion “does not improve outcome and may represent an independent variable predictive of diminished survival” for these patients.³

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