To give or not to give

Rather than making it common practice, an innovative procedure can determine if a patient really needs a blood transfusion

By **Shannon Moneo**

DR. VIVEK RAO COULD ONLY TALK BRIEFLY. The Division Head of Cardiovascular Surgery, and the Peter Munk Cardiac Centre Chair in Advanced Cardiac Therapeutics, had just completed a heart transplant, but the 52-year-old patient was bleeding, and Dr. Rao had to return to the patient.

Beyond the complexity of operating on the body's life-giving organ, cardiac surgery poses the danger of difficult-to-manage or persistent bleeding. In the case of Dr. Rao's patient, a novel technique that addresses blood transfusions was successfully used. Employing what's called a point-of-care algorithm, Dr. Rao and his team determined that the man's platelets – the cells needed to help blood clot – were dysfunctional and so they were replaced.

"The point-of-care testing enabled the team to administer only the required platelets and not a wide range of blood products that would ultimately be unnecessary," Dr. Rao says. As well, Dr. Rao discovered a source of bleeding, which was also controlled. "The patient did well subsequently," he says.

Point-of-care tests are designed to be used at or near the spot where the patient is located, don't require permanent and dedicated space and are performed outside of clinical laboratories. An algorithm is a set of rules to be applied to calculations or problem solving.

At the Peter Munk Cardiac Centre (PMCC), the algorithm addresses blood loss after surgery and allows faster results for targeted therapy, says Dr. Keyvan Karkouti, Site Chief of Anesthesiology at Toronto General Hospital.

"The algorithm allows us, early at the bedside, to identify why patients are bleeding, and once that's identified, to find therapies to target abnormalities we identified," says Dr. Karkouti, who is keenly aware of the algorithm's value.

Between October 2014 and May 2015, a randomized controlled trial of the point-of-care–based transfusion algorithm was tested at 12 Canadian hospitals. None of the sites previously used point-of-care testing for bleeding management during cardiac surgery. During the seven months, the algorithm was used for 7,402 patients having coronary bypass surgery. Overall, the point-of-care algorithm reduced red blood cell transfusions, platelet transfusions and major bleeding following cardiac surgery.

For Dr. Michael Farkouh, the "out-of-box" thinking that led to this valuable algorithm is truly innovation in action. "It's a novel, very cost-effective way of improving outcomes," says the Chair of the Peter Munk Centre of Excellence in Multinational Clinical Trials.

With a limited blood supply and a push to conserve such resources throughout the health-care system, Dr. Farkouh, a cardiologist, foresees broad appeal for the algorithm. "We have the ability to tailor transfusions in patients," he says.

The algorithm works by determining if platelets, red blood cells or plasma are needed via a flow chart. After a blood sample is rewarmed, questions are asked, such as: "What are the clotting defects?" or "How much blood loss has occurred, based on the weight of sponges used to absorb patient blood?" The questions drill down to appropriate treatment, be it no blood products, the use of platelets, plasma or cryoprecipitate, a frozen blood product prepared from plasma.

When heart surgery is performed, heavy bleeding can occur. The more blood that is lost during surgery, the worse the outcome for the patient. Conditions that lead to excessive bleeding during surgery include complex heart surgeries, such as transplants, that result in longer times on the heart-lung machine; complicated, emergency heart surgery; and patients who were taking blood-thinner medications, Dr. Karkouti says.

Use of the heart-lung machine plays a significant role in degrading the patient's blood. During open heart surgery, the heart has to be stopped, so the patient is hooked to the heart-lung machine, which becomes responsible for delivering oxygenated blood to the body. Blood flows out of the heart's right atrium, through the machine and then the now-oxygenated blood flows back into an aorta. But as the blood courses through the machine, the circuitry diminishes the blood's clotting factors, which is one reason why patients need more platelets. As well, synthetic grafts, hypothermia and surgical trauma can affect blood's clotting ability and may lead to the need for transfusions.

Another operating room dilemma is how long a physician waits before treating the bleeding, Dr. Karkouti says. Watching and waiting to see if the bleeding slows is one approach.

Typically, surgeons first use Method A to stop bleeding, based on what they see, Dr. Rao says. If Method A doesn't work, Method B is implemented, then Method C, using the process of elimination, not an algorithm. The bleeding could be caused by a torn suture line, or the patient may have dysfunctional platelets.

The beauty of the algorithm is that it points surgeons in the right direction.

"So far, I've been impressed with the point-of-care algorithm to treat bleeding disorders," Dr. Rao says. "We can now target the actual problem, rather than using a shotgun approach. We're treating a problem – the bleeding – not the symptom."

One minor drawback has been the five or 10 minutes required to receive the point-of-care test results. "We're an impatient bunch," Dr. Rao says of his fellow cardiac surgeons. "They've told me, 'You want me to wait?'" The test also costs between $50 and $100 per patient, more than standard lab tests, primarily due to costs of chemical compounds, Dr. Karkouti says.

Over the last two years, the algorithm has been used for about 3,000 cardiac surgeries at Toronto General Hospital, Dr. Rao says. While the costs add up, there can actually be savings because fewer blood products, such as red blood cells, platelets and plasma, are used during transfusions, Dr. Karkouti says.

Even though Canadian hospitals do not pay for the blood products they use, there is a cost. In Ontario, the provincial government pays Canadian Blood Services.

Blood is an expensive, limited resource and carries serious risks. Each unit costs roughly $650 to $1,550 to deliver from the donor to the patient. Forecasts also predict that the demand may outstrip supply in the near future. As well, transfusions can lead to life-threatening complications, such as infections, acute hemolytic reactions, acute lung injury and volume overload. Moreover, a proportional relation between blood transfusion and mortality has been noted. "The algorithm does lead to better outcomes because we can implement interventions that reduce transfusions," says Dr. Rao, who believes U.S. hospitals will be interested, given that they pay for the blood they use.

But it's early days. "With the management of bleeding patients, there are still lots of questions," Dr. Karkouti says. "The algorithm has improved our care, but there are issues still to resolve of how to best manage patients. There's still a fair amount we don't know about why people bleed. The algorithm has taken us a fair ways, but we still don't know all the answers."

Which leaves the hospital door open for further innovation in action.

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01 Dr. Keyvan Karkouti, left, Dr. Stuart McCluskey and Cielo Bingley, a Perioperative Blood Conservation Co-ordinator, work together to find ways to ensure that with a limited blood supply, opportunities are found to conserve wherever possible.

DROPS OF BLOOD DATA

900,000: Average number of units of blood collected each year in Canada, outside of Quebec.

5: Average number of litres of blood in a person's body.

450 millilitres: Amount of blood that goes into a single donation. Often referred to as a "pint," a blood donation is 450 mL, not the actual 570 mL in a pint.

42 days: Maximum shelf life for red blood cells collected through blood donations. Most blood is sent to hospitals within a week. Platelets have a five-day shelf life. Plasma can be frozen, having a longer shelf life.

Every 60 seconds: How often, on average, someone in Canada receives blood or a blood product.

52%: Proportion of Canadians who say they or a family member have needed blood or blood products for medical treatment.

1 in 10: Number of people admitted to hospital who receive blood.

Heart transplant: Requires 40 units of blood, 30 units of platelets, 25 units of plasma and 20 units of cryoprecipitate.

2: Units of blood needed for hip replacement surgery.

6: Units of blood needed for heart surgery.

20: Units of blood needed for a burn patient.

50: Units of blood needed for a vehicle-crash patient.