Paving the way to truly mend a broken (donor) heart in the future

Anticipated breakthroughs by Peter Munk Cardiac Centre doctors and scientists could lead to more donor hearts, fewer rejections, advanced stem cell treatments and repairs to a patient’s own heart.

By David Israelson

THREE DECADES AFTER THE FIRST SUCCESSFUL HEART TRANSPLANT WAS ACHIEVED IN TORONTO, the medical mystery keeps unravelling, and the miracles keep multiplying.

“We have done more than 700 transplants, and I have been part of the University Health Network. It’s still a remarkable achievement every time it happens,” Dr. Ross says. Thanks to new research and technology, it’s getting more remarkable all the time. Doctors and scientists are on the verge of breakthroughs that promise to increase the success of heart transplants and which may vastly expand the number of patients who can receive the life-saving treatment.

The first successful heart transplant in Toronto took place on November 17, 1968, at St. Michael’s Hospital, performed by Dr. Cane Baker on Charles Pernin Johnston, who lived until 1970. It took place after two earlier transplants in Toronto in which patients died within a week of surgery, as well as less than a year after the world’s first heart-to-heart transplant was performed in South Africa by Dr. Christian Barnard.

In the next 30 years, the possibilities for innovation range from incremental improvements in technology and medications to many Star Trek-like procedures that are so stunning they’re barely imaginable. Dr. Ross says the breakthroughs and discoveries that medical teams are working on now include:

- new medications that lower the risk of cellular rejection;
- the use of donor hearts that were previously considered too damaged to transplant, making transplants available to many more people;
- the possibility of stem cell treatment to repair damaged hearts; and
- taking a patient’s own heart and putting it “on the host” – removing it temporarily for repairs and then reinstalling it, rather than replacing it with a donor’s heart.

“In the first 30 years, nothing has really changed in terms of the surgery itself – until recently,” says Dr. Mitlesh Badawi, a cardiac surgeon at the PMCC. “We take a donor’s heart, flush it and package it in a cooler full of ice.”

Donors are always those who have been declared brain-dead, with no hope of recovery. Brain death is declared when it is clearly irreversible, and it is a legally accepted concept of death in virtually every country in the world.

Still, even when a donor has been declared brain-dead, doctors can use hearts that are damaged. So, many people who need transplants are placed on waiting lists. “We’re probably taking only up to 25 per cent of the hearts from donors. The rest are turned down, sometimes because the donors are really old or have heart disease,” Dr. Badawi explains. At some time, “there are hearts out there that we know have only temporary damage, and even though the donor is brain-dead, the heart has the potential to recover,” he says. Understandably, grieving families want a donor’s heart to be used quickly to save someone, so, Dr. Badawi and his team are working on technology that can repair temporary heart damage as fast as possible.

“We’re testing the machine in the lab now. We hope that later this year, we’ll be able to use human hearts that have been declared as too damaged for transplants and see how many we can bring back,” Dr. Badawi says. “At some point, when we’re confident that the surgery and medication are working well, we’ll be able to take them off the machine and use them for transplants.”

Perhaps an even more exciting aspect of this research into correcting damage is that it may make it literally possible to fix a broken heart. “It gives us an opportunity to potentially repair hearts, with new strategies that are being used in other labs,” Dr. Badawi says. New medications can be used experimentally without putting patients at risk, as heading-edge heartbiology such as gene or stem cell therapy are developed.

“This goes beyond fixing the temporary damage that shows up in donors’ hearts. “We may be able to repair hearts that right now are not useable,” Dr. Badawi says. Our team is also about to begin clinical trials with DCD “donation after circulatory death” – hearts. Unlike hearts that come from donors who are brain-dead, DCD hearts have been considered unreliable for transplants because they stayed beating when the donor died.

Hospitals in Britain and Australia are now using DCD hearts.

“They’ve done this in those two centres nearly 50 times. My team and I visited the facility in Papworth, England (near Cambridge), and we were impressed. They were able to increase their volume of transplantation by more than 50 per cent,” Dr. Badawi says. “We hope to decrease the incidence of patients who die while they’re on waiting lists. Donors’ and families’ wishes must be respected, including when it is appropriate to withdraw life support for a patient who will not recover. The legal definition of a circulatory death in Canada is when a person’s heart has stopped beating for five minutes. Dr. Badawi says.

Which leads to a dream for the future. “We can dream of the device we’re working on to repair hearts becoming a device not just to repair hearts for transplant, but [also] to repair your own heart,” Dr. Badawi says. “Take it out, put it on the machine and transplant it right back into you.”

This is not as far-fetched as it sounds. He points out that patients on waiting lists already survive for short periods – even months sometimes, with mechanical heart devices. Maybe they can do so while their own hearts are on the host.

Yet as promising as the future may be, the present at the PMCC is pretty amazing, too. Dr. Ross says. “I’ve been working in this area for 23 years, and every time we do a transplant it seems like the first time, in terms of miraculous and life-saving potential.”

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