Transcatheter Aortic Valve Implantation (TAVI), which replaces a damaged heart valve with a replacement valve inserted through a small incision in the leg, has been a godsend for patients considered too high-risk for open heart surgery. As a result,so far have been outstanding, with an estimated 20 percent reduction in deaths a year after the procedure. Large randomized studies on high-risk and moderate-risk patients have also shown the benefits of a procedure that can put the patient back on their feet the next day.

“TAVI completely revolutionized how we care for patients with aortic valve disease,” says Dr. Murad Ouzounian, cardiac surgeon at the Peter Munk Cardiac Centre (PMCC). “Before TAVI, patients who were frail or elderly would not have had surgery. Typically, these patients would have died of complications of concerns they would not make it through surgery. We’ve been able to show that patients who do regularly perform TAVI on patients beyond the age of 90, and even those who are in a wheel chair, can go home within a day or two of the procedure.”

TAVI has now Well-entrenched in clinical practice, doctors and scientists are eying the next wave of innovations in heart valve care.

A huge momentum in innovations has created an enormous momentum in heart valve innovations and has set the stage for future heart valve care. These innovations are tackling the other three valves of the heart—through less-invasive procedures. As a result, the clinical realities in heart valve care, the PMCC has only access to many of these innovations — initially through clinical trials, followed by widespread approval. The PMCC is on the cutting-edge of these advances and is one of a few centres in Canada routinely providing transcatheter valve repair or replacement for each of the four valves of the heart.

Experience and infrastructure key to accessing new technologies

The PMCC has a highly functional and experienced team with a strong reputation nationally and internationally, says Dr. Ouzounian. “We’ve been doing TAVI since 2006 and are recognized nationally as a centre able to tackle cases of greatest complexity. That’s important to companies that are developing these new technologies. They want to ensure that a highly experienced group, who would have the capability of achieving outstanding results with novel technology — there’s just too much at stake. The expertise we bring to the table is critical to achieving great results for our patients.”

Having a robust and sophisticated clinical infrastructure has also been critical in gaining early access to new innovations, says Dr. Mark Osten, a PMCC cardiologist and lead investigator into new structural heart disease devices.

In the PMCC’s state-of-the-art operating rooms, which include two hybrid operating rooms, one that features a CT scanner and fluorescence machine and another that incorporates diagnostic imaging equipment — that support more complex procedures.

“The companies that make these new technologies recognize that we have the expertise, the infrastructure, the support of our institution and an incredible breadth of experience in the care of patients,” says Dr. Osten. “We’re one of the highest-risk centres in the country.”

So what new heart valve innovations are the PMCC doctors testing today? The latest technologies offer the potential for major improvements in patient-specific therapy for patients who otherwise would be in profound heart failure or die. Novel technologies have been designed to address each of the four valves of the heart, relieving leaking and stenotic (narrowed) valves and improving the flow of blood to the body.

UP AND COMING: THE LATEST INNOVATIONS AND APPLICATIONS IN HEART VALVE CARE

MitraClip

Doctors at the PMCC use a device called the MitraClip to treat patients with severe mitral valve regurgitation — a disease characterized by a mitral valve leaflet that’s prolapsing into the lower chamber (right ventricle). When the lower chamber is enlarged, the mitral valve leaflets and pulsed aorta, and the flap no longer fit in the center, causing blood to pump backwards. MitraClip is designed to close the mitral valve leaflet and clip it, forming a “spacemaker” between the leaflets. Patients can often be discharged home the next day.

“We will be looking for specific patient traits that will work well for MitraClip, including the amount of calcium in the valve leaflets, and whether the opening and the geometry of the valve and surrounding structures are optimal,” she says. “Right now, there really aren’t any in the world with enough experience in this type of procedure, and it is still experimental.”

Transcatheter mitral valve replacement

The success of TAVI has encouraged researchers to push for similar advances in minimally-invasive mitral valve replacement. A number of medical device manufacturers have been investigating how to use minimally-invasive techniques to access the mitral valve to repair or replace the valves. Dr. Osten says she and the other cardiac surgeons at the PMCC are known as “first in the world to evaluate it. It will be exclusive to the PMCC.”

Back to TAVI: From revolution to evolution

EVOQ is a new transcatheter mitral valve replacement application. Dr. Eric Hrotolak, a cardiologist at the PMCC, says he plans to enroll 100 patients in the clinical trial to test a new treatment for mitral valve disease. "We will be looking for specific patient traits that will work well for MitraClip, including the amount of calcium in the valve leaflets, and whether the opening and the geometry of the valve and surrounding structures are optimal," she says. "Right now, there really aren’t any in the world with enough experience in this type of procedure, and it is still experimental."