

Peter Munk Cardiac Centre

CLINICAL AND RESEARCH REPORT



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CARDIOVASCULAR SURGERY

A fresh start for the heart

MECHANICAL HEARTS ARE GIVING
HOPE AND SAVING LIVES

Every moment of your life is a second chance. Such is the case with Marcel Powell.

The last thing the twenty-seven year-old musician remembers before fainting in the waiting room of the Hamilton General Hospital in May of 2015 is being with his goddaughter and fiancée. He awoke five days later in a hospital bed at the Peter Munk Cardiac Centre with a mechanical pump secured to his heart.

"Marcel came to us in a severely compromised state," recalls Dr. Viv Rao, Head, Division of Cardiovascular Surgery at the Peter Munk Cardiac Centre. "He was put on immediate life support to maintain blood flow and oxygenation to his body's vital organs. He had several blockages in his coronary arteries, which was unusual for a man of his age. There were some prior risk factors that led to this. As a result, Marcel underwent bypass



Mechanical heart recipient Marcel Powell and his wife Maria.

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ABOUT THE PETER MUNK CARDIAC CENTRE

The Peter Munk Cardiac Centre is the premier cardiac centre in Canada. Since it opened in 1997, the Centre has saved and improved the lives of cardiac and vascular patients from around the world. Each year, approximately 55,000 patients receive innovative and compassionate care from multidisciplinary teams in the Centre. The Centre trains more cardiologists, cardiovascular surgeons and vascular surgeons than any other hospital in Canada. It is based at the Toronto General Hospital and the Toronto Western Hospital, members of University Health Network, which also includes the Princess Margaret Cancer Centre and Toronto Rehabilitation Institute. All four sites are research hospitals affiliated with the University of Toronto. For more information please visit www.petermunkcardiaccentre.ca

...A fresh start for the heart continued.

surgery and subsequently needed a mechanical cardiac assist device to maintain his heart function.”

On May 28th, 2015, cardiovascular surgeon Dr. William Stansfield and a multidisciplinary team performed a delicate operation to implant the mechanical heart on Marcel’s left ventricle, the lower chamber of the heart that receives blood from the left atrium and pumps it out under high pressure through the aorta to the body. The device uses a tiny, continuously moving propeller to help blood flow. The mechanical heart would support Marcel’s damaged heart until its function recovered or until a matching donor heart could be found.

Like any major medical event, having a mechanical heart implanted and adjusting to life with it was stressful and emotionally difficult for Marcel. The idea of having to learn about a new technology right after heart surgery was at times overwhelming.

“I realized I had to make some drastic lifestyle alterations to adjust to life with the pump and adopt a healthier lifestyle,” says Marcel. “One thing that really kept me going was my artwork. Writing music instilled in me the positive belief that things were going to take a turn for the better.”

Light at the end of the tunnel

When one considers the sobering statistics about heart failure in Canada, Marcel’s chances of finding a new heart were dim. Every year in Canada, more than 50,000 people are diagnosed with heart failure. Of those, 2,000 have advanced heart failure. There are approximately 200 heart transplants



An example of the mechanical heart that was implanted on Marcel’s left ventricle.

performed a year in Canada, leaving about 1,800 people across the country who are still in need of a heart transplant or who could benefit from a mechanical cardiac assist device.

Luckily for Marcel, over the course of the next year, something truly remarkable started to take place with his heart – it slowly started to regain its function with support of the device. Indeed, this was a very rare occurrence. There had only been one successful explant of a mechanical heart in the program’s history.

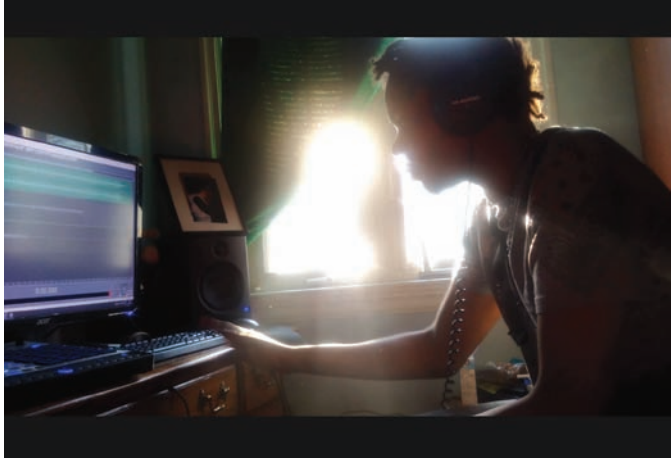
“Most of the time when we see native recovery after a mechanical heart implant, it is after a short term,” says Dr. Rao. “We take the patient in, treat them and a week later they are on their way. In Marcel’s case, we started to notice recovery over a prolonged period of time (several months) to the point that we put him on hold on the transplant list. At his age it would be much better to have the pump taken out.”

A year and four months later, on September 28th, 2016, Marcel returned from his honeymoon to have his mechanical heart removed – a complex procedure whereby doctors had to work around a significant amount of scar tissue to partially remove the device.

“We essentially turned the pump off and cut off one part of the device so that there was nothing leading into Marcel’s heart anymore,” says Dr. Rao. “For Marcel, it’s important that he still recognizes that he has a heart problem, has had heart issues in the past, and is still at risk for developing heart issues in the future. He needs to be seen very closely by the PMCC cardiologists to prevent reoccurrence.”

A team approach

The team effort to save Marcel’s life cannot be understated. The belief that patients are best served in a team-



“One thing that really kept me going was my artwork. Writing music instilled in me the positive belief that things were going to take a turn for the better.”

- Marcel Powell

based approach at the PMCC allows for different perspectives, taking the skills of multiple healthcare professionals and using them on patients with complex problems such as Marcel.

“Cardiologist Dr. Phyllis Billia, nurse practitioners Marnie Rodger and Jane MacIver were nothing short of amazing,” says Marcel’s wife, Maria. “They helped keep Marcel alive, and you can be sure that he will repay that debt by taking better care of his heart.”

The Mechanical Heart Program is one of only a few programs in the country that can offer patients like Marcel this life-saving treatment. In fact, it is not uncommon to find transplant cardiologists in other centres across Canada who trained at the PMCC.

“We’re hoping to show in the long-term that there will be a cost-saving to the entire healthcare system because these devices reduce re-hospitalization,” says Dr. Rao. “Because of limited funding, in Canada we’re only doing approximately 1% of potential patients that are eligible for a mechanical heart.”

Donors play a vital role in funding these devices. In so doing, they allow the PMCC to provide proof-of-concept to the Ontario Ministry of Health and Long-Term Care to further fund innovative healthcare technology of this kind. It’s an invaluable model very much indicative of what future funding for healthcare technology will look like. Despite all that we can do to encourage the public to register to become a donor, donations for heart organs have not increased. The mechanical heart is a wonderful answer to that problem. And philanthropy is the key to its success.

“I was given a second chance at life,” says Marcel. “Not a lot of people on the transplant list get off. I was extremely fortunate. I’m only twenty-seven. I still have my entire life in front of me. And the only reason I’m alive today is because of the team at the Peter Munk Cardiac Centre.”

MILESTONES

MECHANICAL HEART PROGRAM

NOV 2001	1st left ventricular assist device (VAD)/mechanical heart implant at the PMCC
MAR 2005	25th VAD implant Thoratec BiVad
JUNE 2006	1st Continuous Flow VAD implant HeartMate 2
JAN 2007	50th VAD implant AB 5000
OCT 2009	75th VAD implant HeartMate 2
OCT 2010	1st Canadian left ventricular assist device (LVAD) implant at the PMCC DuraHeart
FEB 2011	100th LVAD implant HeartWare
OCT 2014	1st Canadian implant of next-generation mechanical heart device HeartMate 3
SEP 2016	200th LVAD implant at the PMCC

FOCUS ON INNOVATION

Driving change through healthcare innovation

POINT-OF-CARE BLOOD CONSERVATION MANAGEMENT BECOMING STANDARD OF CARE ACROSS UHN

Necessity is the mother of invention. Ideas that make their way into our healthcare system have the potential to change the way we deliver care for the benefit of patients. Such is the case with the Peter Munk Cardiac Centre's Innovation Fund. Initiated in 2012 through the support of donors, the Innovation Fund has supported close to 40 projects at the PMCC, many of which have the potential to trigger sustainable and systemic changes in the delivery of health services to patients across Canada.

"One key challenge for us before the inception of the Innovation Fund was the lack of any dedicated funding or mechanism to drive systemic innovation in our hospital," says Dr. Barry Rubin, Medical Director of the PMCC. "It's often the case that technology which improves healthcare outcomes is substantially more expensive than the procedure that is being replaced. Our TAVI (transcatheter aortic valve implantation) Program is a perfect example of this. Although more expensive than standard open heart treatment to treat damaged valves, use of this technique has allowed high-risk patients to be treated with a minimally-invasive surgical procedure, thereby reducing subsequent costs of treatment and reducing overall costs for the healthcare system in the long run. Now the program is funded by the Ministry of Health and Long-Term Care because of its realized value."

Part of the mandate of the PMCC is to establish a clearly-defined process



University Health Network has studied and incorporated point-of-care blood conservation management as part of standard care. From left, the PMCC Innovation Fund recipients that spearheaded this project: Cielo Bingley, Dr. Keyvan Karkouti, Dr. Stuart McCluskey, Chris Cursio and Arpita Kundu.

that enables innovation. Clinicians and researchers are encouraged to push boundaries, take risks and create a culture that fuels inquiry and innovation.

Inception to Conception

"Normally, to go from a concept to a single-centre study to a multi-centre study, it can sometimes take up to ten years," says Dr. Keyvan Karkouti, Deputy Anesthesiologist-in-Chief at Toronto General Hospital and a grant recipient of the Innovation Fund.

"With the Innovation Fund, we started a project in 2013 and in 2016 (September) were able to publish a paper in *Circulation* on a

multi-centre pragmatic clinical trial. Using traditional funding paths, this likely would not have been possible."

Dr. Karkouti is referring to a project that was conceived three years ago and was aimed at reducing blood loss and blood product transfusions in cardiac surgery, which is one of the highest users of blood products. Subsequent funding from the CIHR to pilot the initiative across twelve hospital sites demonstrated that point-of-care testing significantly reduces red blood cell transfusions, platelet transfusions, and major bleeding following cardiac surgery.

“Our findings support the broader adoption of point-of-care blood testing into clinical practice,” says Dr. Karkouti. “Our next step is to demonstrate to the Ministry of Health that supporting this practice will save money and improve patient outcomes by reducing red blood cell transfusions.”

Risk-Return Tradeoff

The Innovation Fund has allowed clinicians and researchers to take big leaps of faith that they otherwise would not have taken.

“It allows us to perform early-stage studies that are at high-risk for failure,” says Dr. Karkouti. “Nine

out of ten times, early-stage studies turn out to be negative, but the odds that one turns out positive can have a major impact on clinical practice.”

A perfect example of this is Dr. Karkouti’s latest Innovation Fund project examining the use of hyperbaric therapy to treat patients at high risk for kidney failure following heart surgery, which is a first-in-human study.

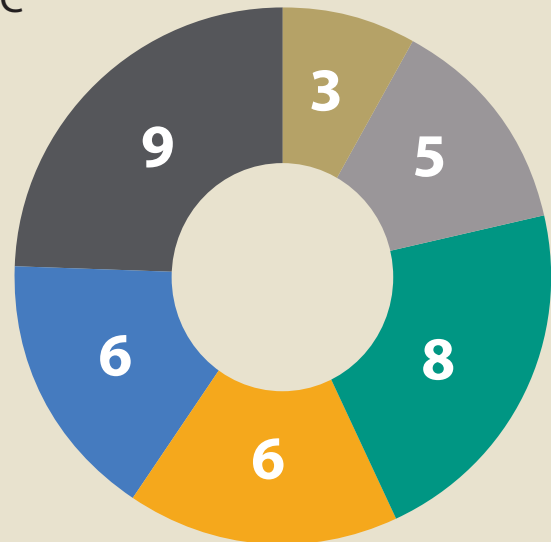
“We think that hyperbaric therapy may reduce kidney injury after cardiac surgery by improving oxygen delivery and reducing inflammatory damage to the kidney,” says Dr. Karkouti, who has received funding to pilot this study on 20 patients over two years. Five patients have already been included in the study.

“The Innovation Fund is allowing us to improve and transform Canadian healthcare delivery,” says Dr. Karkouti. “It’s exactly what our healthcare system needs more of - flexibility and innovation in policy and management. And we have it in place because of donors who believe in our ability to impact change. They give us the opportunity to take risks so that we can develop novel solutions that validate our expertise in cardiovascular care and research.”

PROJECTS SUPPORTED BY THE PMCC INNOVATION FUND – 2012 - 2016.

- Imaging Technology
- Cardiovascular Devices
- Education/Web
- Stem Cells
- Pilot Clinical Trials
- PET/MRI

TOTAL PROJECTS = 37



FOCUS ON RESEARCH

How to improve decisions for acute heart failure patients in the emergency department

BY DR. DOUGLAS LEE, TED ROGERS CHAIR IN HEART FUNCTION OUTCOMES

Heart failure has a high fatality rate and, along with this risk, it is also one of the costliest disease conditions in all of healthcare.

Often, the care of heart failure patients has a “one-size-fits all” approach. Physicians tend to treat all patients with the condition the same way. Consequently, the care of heart failure patients is not necessarily tailored to their prognosis. In other words, there is a lack of “precision” in how clinicians manage heart failure patients because an individual’s prognosis is not routinely considered in day-to-day care.

Important decisions such as whether to admit a patient with acute heart failure to hospital are not immune to our tendency to treat all patients uniformly. Thus, the majority of heart failure patients who present to the emergency department are admitted to hospital, typically spending over one week on the ward. As a result, somewhat “healthier” patients are often admitted to hospital, while “sicker” patients (who may not appear unwell to the treating physician), might be inappropriately discharged home.

What if we could identify the patients who are lower risk and could actually go home instead of stay in-hospital? Can we identify high-risk patients who should not be discharged home despite a good response to initial treatment?

These notions are at the heart of an algorithm my team has developed.



Dr. Lee’s work aims to identify best practices in the prevention and treatment of patients with heart function abnormalities.

It’s a tool called the *Emergency Heart Failure Mortality Risk Grade (EHMRG)*.

Seven-Day Mortality Risk

This online tool helps identify a heart failure patient’s risk level of dying by entering their information into a calculator.

By knowing that a patient’s risk is low, physicians may feel more comfortable discharging home heart failure patients with a prognostically favourable outcome. Alternatively, lower risk heart failure patients can be discharged earlier than the typical eight-day hospital stay. The benefits to patients are clear, and the hospital

itself has more control over the flow and usage of beds, which in turn elevates the level of care for all patients.

EHMRG is used now in many countries and has been recently validated by a team in Barcelona. A multi-centre prospective validation of EHMRG is currently ongoing in Ontario, where one of the objectives will be to compare the risk score with physician-estimated risk. Thus, this study will definitely determine if the predictions made by EHMRG provide better discrimination or reclassification of patient risk than the physicians’ diagnosis.

30-Day Mortality Risk

We modified the seven-day model to develop a new application that can simultaneously predict a patient's risk of death over a full month. This new algorithm charts a patient's probability at seven days and at 30 days – critically important for care if you consider that a person could be low-risk at one week and high-risk at one month. I believe this type of multi-dimensional prognostication is where risk modelling is headed, as people are interested in multiple outcomes – in this specific case, outcomes at two different time points.

This combined seven-day and 30-day model is currently being tested prospectively, in a randomized

controlled trial and results are expected in two to three years. The objectives of this trial, entitled the Comparison of Outcomes and Access to Care for Heart Failure (COACH), are to determine if care decisions directed by using the 7/30-day EHMRG model will improve decision-making in the emergency department, reduce hospitalizations and improve survival.

I am drawn to this work because it is such an important area. One in 25 heart failure patients die within 30 days of their presentation to the emergency department. Consequently, there is much fear about sending patients with heart failure home from the emergency department.

Using tools that can improve physicians' ability to prognosticate may enable better decisions resulting in fewer low-risk admissions to hospital and conversely, fewer high-risk patients being inadvertently discharged from the emergency department.

The net effect could be a reduction in hospitalizations and potentially moving the needle down. Dropping admission rates by just a few percentage points will result in enormous savings to the healthcare system.

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In the news

First-of-its-kind event raises awareness and support for rare, genetic cardiac condition

Patients, physicians and supporters gathered at the Caledon Mountain Trout Club on September 14th, 2016 for the first *Cast & Blast* event to support research into the often fatal heart disorder called arrhythmogenic right ventricular cardiomyopathy (ARVC). This condition can strike without warning, resulting in sudden cardiac death in young, athletic people. Spearheaded by Heather and Meredith Cartwright, both ARVC patients, and their brother Brian, the event netted \$120,000 in support of the Heather Cartwright Inherited Cardiomyopathy and Arrhythmia Project at the Peter Munk Cardiac Centre.

Led by heart failure and transplant specialist Dr. Heather Ross, and Dr. Danna Spears, a cardiac electrophysiologist with expertise in the electrical rhythms of the heart, the project will use genetic testing and imaging to pinpoint biomarkers of past, current and future cardiac patients. These biomarkers will help identify the cause of specific cardiomyopathies that run within families. The project will also create a registry for inherited arrhythmias.



With instruction from Caledon Mountain Trout Club members, guests and docs enjoy the experience of the shooting range.

Award Winner

Dr. Dinesh Thavendiranathan, cardiologist, Peter Munk Cardiac Centre, and Director of the Ted Rogers Centre for Heart Research Program in Cardiotoxicity Prevention was awarded the *Medical Young Investigator Award: Clinical Science* by the Canadian Cardiovascular Society during its annual Congress in October 2016. The award, which is handed out annually, was established in 1970. The Ted Rogers Centre for Heart Research Program in Cardiotoxicity Prevention is the world's first program that focuses on managing cardiotoxicity from any systemic therapies, uniquely situated to leverage the cardiovascular expertise, databases, imaging and patient groups available at University Health Network.



Dr. Dinesh Thavendiranathan, Director of the Ted Rogers Centre for Heart Research Program in Cardiotoxicity Prevention at the PMCC.

For more information, or to support the PMCC through a donation, please visit www.petermunkcardiaccentre.ca or call **416-340-4056**

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