FRONTIER

THE MAGAZINE OF MACQUARIE UNIVERSITY HOSPITAL | WINTER 2023

GAME-CHANGING ROBOTIC TECHNOLOGY

FOR THE WORLD'S DEADLIEST CANCER

(YOU)us

Urological surgeon completes his 1000th robotic case

Green dye maps the way in early lymphoedema intervention

Spine surgeons and patients benefit from 7D navigation

MACQUARIE UNIVERSITY Hospital

Macquarie University Hospital offers a new era in Australian healthcare. We are part of MQ Health, Australia's first fully integrated university-led academic health sciences centre.

MQ Health represents the convergence of the continuous learning and research endeavours of Macquarie's Faculty of Medicine, Health and Human Sciences with the clinical care provided at Macquarie University Hospital, primary care and multispecialty clinics.

At MQ Health, we multiply our ability to achieve remarkable things. That's You to the power of us.

Walter Kmet

Front cover image left to right: Associate Professor Tajalli Saghaie, Professor Martin Phillips, Associate Professor Jonathan Williamson, Professor Alvin Ing, Dr Sarika Sundar.

Please note any surgical or invasive procedure carries risks. Before proceeding, you should seek a second opinion from an appropriately qualified health practitioner.

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ISSUE 21

Welcome

TO MACQUARIE UNIVERSITY HOSPITAL

In this edition we have several remarkable milestones to celebrate, including the achievement of another 1000th successful robotic surgery case milestone for one of our surgeons. At Macquarie University Hospital, we have been early investors in robotic surgery technology, recognising its immense potential to revolutionise surgical procedures and enhance patient outcomes.

We also highlight a world-first clinical trial that is set to revolutionise the early detection of the world's deadliest cancer. This trial involves the use of robotic technology that enables doctors to access tiny nodules located in the deepest parts of the lungs, and the initial results are already showing immense promise.

Lung cancer is a devastating disease, often diagnosed at advanced stages when treatment options are limited. However, this new robotic technology has the potential to be a game changer in detecting lung cancer at an earlier, more treatable stage. By providing doctors with the ability to reach these previously inaccessible nodules, we can improve the chances of early detection and ultimately save lives.

In addition to our advancements in robotic surgery, we are also proud to be at the forefront of groundbreaking research. Our hospital is currently involved in an innovative study called the ATLAS Preventative Trial. This research focuses on identifying the optimal timing for patients with the faulty SOD1 gene to receive tofersen infusions, a potential treatment for motor neuron disease (MND). As the sole site in the Southern Hemisphere participating in this trial, we are privileged to be contributing to this global effort.

We are excited to advise you that our new world-class orthopaedic unit project is well underway, dedicated to delivering exceptional care and superior outcomes for our patients.

This unit represents a harmonious fusion of expert orthopaedic surgeons, state-of-the-art facilities, and an enhanced recovery after surgery (ERAS) model of care.

What truly sets our new orthopaedic unit apart is our adoption of the ERAS model of care. This patient-centred approach focuses on optimising the entire surgical journey, from pre-operative preparation to post-operative recovery.

We are proud to provide this world-class orthopaedic unit to the community, and we look forward to partnering with you to achieve new milestones in orthopaedic care and empower our patients to live their lives to the fullest.

We feature many other articles about the amazing research we do here as well as provide an insight into our end-to-end breast care services.

Macquarie University Hospital remains committed to pushing boundaries and driving innovation in healthcare. We strive to provide exceptional patient care and embrace emerging technologies and research to improve the lives of individuals and communities.

Through collaboration with leading experts, ongoing investments in state-of-the-art equipment, and a dedicated team of professionals, we continue to lead the way in delivering outstanding medical services.

I extend my gratitude to the remarkable staff at Macquarie University Hospital for their tireless efforts, to our patients and their families for placing their trust in us, and to our GP community. Together, we are shaping the future of healthcare.

Walter Kmet

Chief Executive Officer
Macquarie University Hospital and Clinical Services

UROLOGICAL SURGEON COMPLETES HIS

1000TH ROBOTIC CASE

While prostatectomy using a robotic approach is now the standard and the most commonly performed urological procedure at Macquarie University Hospital, increasingly other robotic urological procedures are showing significant promise.

Walter Kmet (CEO), Professor David Gillatt, Professor Howard Lau, Professor Manish Patel

Macquarie University Hospital urological cancer surgeon Professor Manish Patel recently completed his 1000th robotic surgery case using the da Vinci surgical system. His achievement is indicative of the high-volume robotic centre that the hospital has become, in part due to its early investment in robotic technologies.

"I did the first robotic case at Macquarie University Hospital many years ago when the hospital acquired its first da Vinci surgical system," explained Professor Patel who, in addition to receiving his FRACS, was awarded a uro-oncology fellowship from the world-renowned Memorial Sloan Kettering Cancer Center in New York.

"Initially, we focused on prostate cancer – mostly radical prostatectomies – as well as partial nephrectomies. A robotic approach has now become the standard for both procedures, and with Macquarie University Hospital now a leading high-volume centre, we are seeing fantastic results for patients.

"Continence outcomes are vastly improved compared to open surgery. Return to full erectile function is substantially faster. Hospital stays are short and pain levels are very low, with patients leaving hospital within a few days on just Panadol at most. At the six-week review, they look great, compared with those who have had open surgery and come in hunched over and walking slowly."

Professor Patel has introduced two other urological robotic approaches that are changing the field. For young men with testicular cancer, the recommended procedure is retroperitoneal lymphadenectomy – removal of lymph node tissues in the abdomen along with resection of any residual mass. It's not a simple procedure and few urological surgeons in Australia perform it.

"Traditionally, these patients had to undergo a huge cut from sternum to pubic bone that damages nerves affecting ejaculation," he explained. "Hospital stay with this approach is usually around 10 days. Now with keyhole surgery, they are in hospital for two days and the nerve sparing is excellent. It's a fairly rare operation and I have done 16 in total."

Professor Patel has also introduced robotic inguinal node dissection to MQ Health, with the approach significantly reducing the risk of lymphoedema. Traditionally, the operation involves a cut in the groin, introducing a high risk of infection, wound breakdown and lymphoedema. Done robotically, the instance of lymphoedema has been reduced from 50 to three per cent.

"I have done more than 30 inguinal node dissections using the da Vinci," explained Professor Patel. "We are unique in this, as nationally and overseas, generally, surgeons are not doing node dissections robotically. I performed the first case collaboratively with a Melbourne colleague, and we now complete the procedure quickly and effectively.

"Penile cancer is spread by the lymphatic system to the pelvic lymph nodes, so it's important that all lymph nodes in the area are removed. This is important because once you develop lymphoedema, it is with you forever."

Macquarie University Hospital now has two da Vinci surgical systems and one Versius system. The hospital uses this surgical equipment along with other robotic-assisted technologies across many fields, including cardiology, neurosurgery, colorectal surgery, orthopaedics and gynaecology for diagnostic and intra-operative scanning systems.

Professor Patel joins Professor David Gillatt, Professor Howard Lau and Professor Felix Chan who have all achieved the 1000-case milestone in robotic surgery.

Macquarie University Hospital CEO Walter Kmet said that the hospital's early investment in robotic surgery positioned it well to be the leader that it has become.

"The MQ Health model is based on the delivery of advanced and innovative healthcare in an academic setting," he said. "Integrating robotic-assisted technology has been a key part of this, and will continue to be as machine learning and artificial intelligence increasingly contribute to achieving optimal outcomes for patients."

FOR MORE INFORMATION
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Breast care at MQ Health is comprehensive, with all services available in one location. In addition, a Breast Multidisciplinary Team (MDT) and dedicated breast nurses ensure patients receive care that is thorough, integrated and supportive.

END-TO-END BREAST CARE

Dr Negin Sedaghat

Specialist breast surgeon Dr Negin Sedaghat sees firsthand how patients benefit from the comprehensive and seamless care offered at MQ Health, and she would like more women and their GPs to know that this model of care is available.

"In working with GPs in the community, I know that many who are managing patients with breast cancer and other breast conditions are not always aware that MQ Health has such a comprehensive service," she said. "All the necessary elements of breast care – from diagnosis to treatment and follow-up services – are here, in a single location."

If patients are referred by their GP, their first appointment is usually with Macquarie Medical Imaging (MMI) where ultrasound, mammogram and MRI – as well as biopsy facilities such as fine needle or core biopsies – are all available. Specimens are analysed by Douglass Hanly Moir – also on site.

Any atypical, suspicious or confirmed malignancy cases are discussed in detail at the Breast MDT meeting, which is made up of breast surgeons, medical oncologists and radiation oncologists from GenesisCare. Allied health practitioners and MMI radiologists also attend.

"All options for patients are discussed and presented, with several advanced treatments available," explained Dr Sedaghat. "If surgery is required, we have, for example, access to intraoperative specimen X-ray to determine accurately the extent of tissue removed. If needed, our team can perform advanced and complex breast reconstruction – either at the time of surgery or in a separate procedure.

"Through the Macquarie University Clinical Trials Unit, patients have access to novel therapies not yet widely in use. And GenesisCare offers molecular testing to clarify the need for radiation therapy after cancer surgery, based on an individual's tumour profile."

Two important members of the breast care team – Ruth Cho (the McGrath Breast Health Nurse) and Jenny Gilchrist (Nurse Practitioner in Breast Oncology, one of only four in Australia) – support patients from diagnosis to well after treatment and are always available to patients should they need support.

ALERT – the world-renowned MQ Health-based Australian Lymphoedema Education, Research and Training program – captures each patient's baseline lymphoedema data and follows them up for signs of post-surgical lymphoedema in an effort to catch and treat the condition early. Allied health services such as psychology and physiology, along with a robust survivorship program all contribute to excellence in care.

"It really is a distinguishing feature of our breast service that whatever a woman requires, the service is right here," said Dr Sedaghat. "No travel is required; they get to know their way around the hospital; and they benefit from long-term relationships with our clinical and hospital staff."

Dr Sedaghat is a highly qualified specialist breast surgeon and surgical oncologist. She specialises in breast cancer and breast health including a wide range of advanced oncoplastic, symmetrisation and reconstructive breast surgery. Her practice also includes thyroid and parathyroid gland surgery, skin/soft-tissue lesions and hernia repair.

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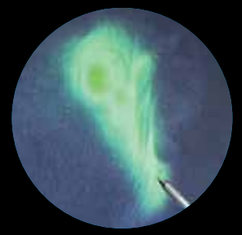
Jenny Gilchrist, Dr Negin Sedaghat, Ruth Cho



Green dye maps the way in early lymphoedema intervention

Associate Professor Louise Koelmeyer

Cutting-edge diagnostic technology used by the Australian Lymphoedema Education, Research and Treatment (ALERT) Program at Macquarie University is improving the lives of cancer patients and others at risk of lymphoedema by detecting the condition in its earliest stages.

Lymphoedema can occur if lymph nodes are removed during cancer surgery, or it may be a chronic condition. Without appropriate treatment, the resulting build-up of fluid can result in one arm or leg being significantly larger than the other, impacting mobility, mental health, self-confidence, and quality of life.

While lymphoedema cannot be cured, it can be managed, and early detection improves the chances of effective intervention.

ALERT's lymphoedema multidisciplinary clinic is harnessing the power of indocyanine green (ICG) lymphography to map lymphatic tissue, and it has been a game changer for patients.

"Our imaging experts inject dye into the affected limb, then use an infrared camera to identify the tiniest disruptions in the vessels," ALERT Program Director, Associate Professor Louise Koelmeyer, says.

"Before we had access to this technology, we were flying blind. Now we have a full visualisation of what's happening underneath the skin very early on, and it allows us to create a personalised treatment plan focusing on the affected areas."

Patients come from all around Australia and New Zealand to be assessed and treated at the Lymphoedema Clinic, and ALERT's education program draws health professionals from both countries.

ALERT is also known for its research into improved lymphoedema treatments. A recent study used ICG lymphography to show in real time that firm, slow massage is more effective in helping drain fluid build-ups from affected limbs than the previously accepted gentle massage; researchers have also proved that bioimpedance spectroscopy is more effective than the traditional measuring tape to detect the changes that signal fluid build-up.

Effective treatment can be life changing for a person with lymphoedema, but there is no one size fits all approach.

The ALERT Program at Macquarie University provides a personally tailored, evidence-based approach for each of its clients.

Associate Professor Koelmeyer says the program's Lymphoedema Clinic is a true one stop shop, with patients able to consult a number of clinicians in a single visit.

"The nature of lymphoedema requires a broad range of specialists working together, so simply seeing a lymphoedema specialist isn't enough," she says.

"We have two plastic surgeons specialising in advanced liposuction and microsurgery, rehabilitation specialists, a lymphatic anatomy researcher, an imaging specialist, accredited lymphoedema therapists, physiotherapists, occupational therapists, exercise physiologist, dietitian, a research team who take measurements for every patient, and a practice manager who coordinates patient movement, and we meet as a team to discuss in detail the best approach for each person."

"People fly in from as far away as Western Australia and New Zealand to attend our clinic, and we ensure they move seamlessly from one discipline to the next, eventually leaving with a tailored plan for their care, which can be with us or enacted by clinicians closer to home."

Everyone comes to the clinic with different goals, from wanting to stop wearing compression garments to reducing the size of a swollen arm or leg to fit into regular clothing. Some cases require surgical intervention, while others can benefit from less invasive methods.

"Whatever their circumstances, we ensure the patient is always at the centre of the process," Associate Professor Koelmeyer says. *

FOR MORE INFORMATION

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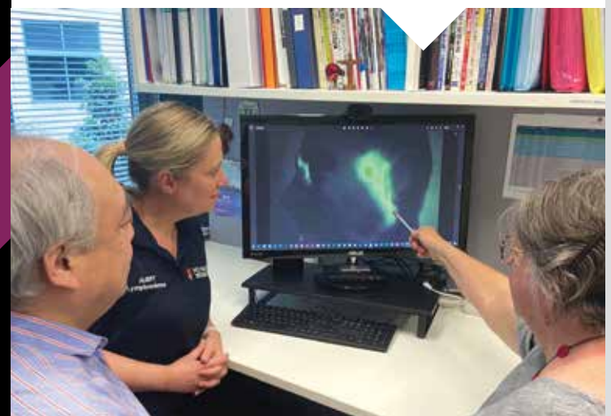
Associate Professor Hiroo Suami, Robbie Blackwell, Dr Helen Mackie



Elaine

Lack of understanding leads to lipedema going undiagnosed

Lipedema mostly affects women, and is more common than many people realise, with about 11 per cent of women likely to be affected. The condition results in the build-up of fat under the skin, and its symptoms include swelling, tenderness and bruising. Often, it occurs at the same time as hormonal changes such as pregnancy and menopause.

Unlike lymphoedema, lipedema often presents as a symmetrical enlargement of the limbs.

Elaine began to notice a feeling of heaviness in her legs, and that they were increasingly tender. One day when someone accidentally hit her with a shopping trolley, the pain was excruciating.

The condition often runs in families, and she thinks now her great aunt on her mother's side and also aunts on her father's side may have had it too. At the time, everyone assumed that they were simply of a naturally stocky build.

Looking back, Elaine realises that her lipedema developed in the early 1970s, when she was pregnant for the second time.

"My mother had made me a beautiful maternity dress when I had my first child, but when I tried to wear it again, it was too tight in the arms," she says.

It was not until her own daughter developed the condition in 2017 and began researching the symptoms that Elaine realised she had been living with lipedema for more than 45 years.

"My daughter came to me one day and said, 'Mum, I know why we've got big legs. We've got lipedema."

Discovering that compression garments could be helpful in reducing pain and swelling in lipedema, Elaine bought some compression socks. The knee-high version made her feel as though they were cutting off the circulation but wearing the thigh-high pair brought almost instant relief.

Elaine also got a referral to a specialist and came to the MQ Health Lymphoedema Clinic for the first time, where she started seeing lymphoedema therapist Robbie Blackwell.

Her daughter elected to have surgery, but Elaine, who was in her mid-70s, decided against surgery for herself based on her age and the long recovery period.

Five years later, she continues to make regular visits to the clinic, where Robbie measures her limbs, provides therapy, discusses her options, and organises for custom-made compression garments.

New drug offering hope to MND patients

For the first time, a breakthrough genetic treatment is prolonging life for people with an inherited form of motor neuron disease (MND), triggering new hope for other forms of the deadly neurodegenerative condition.

Professor Dominic Rowe

About 2500 Australians are currently living with MND, and another 800 are diagnosed each year.

Also known as amyotrophic lateral sclerosis (ALS), MND causes the progressive loss of the neurons that allow the brain and spine to communicate with the muscles.

Patients in the early stages of the disease begin by experiencing muscle weakness, but as it progresses, they gradually lose the ability to walk, speak, swallow and breathe unaided.

Until now, it has been untreatable, and most patients die within two to five years of diagnosis. MND is either inherited, or sporadic.

Only about 10 per cent of MND is inherited, but to complicate matters, the same genetic anomaly is not responsible in every case.

In 1993, SOD1 was the first gene to be identified as causing MND, but more than 40 other genes have since been linked to the disease.

Tofersen, which was developed by international biotech company Biogen in collaboration with Ionis Pharmaceuticals, recently received approval from the US Food and Drug Administration to treat the symptoms of SOD1 MND.

In Australia, it has been available to patients under the Extended Access Scheme for 21 months.

But tofersen's developers also hope that it could prevent the symptoms of SOD1 MND from developing at all if administered early enough, and this is being tested through an international clinical trial.

Previous research discovered that when neurons are damaged, a protein known as neurofilament light chains, begins to leak from them and appear in the blood and other bodily fluids.

This early warning sign can be identified through blood tests well before the symptoms of neurological damage begin to take hold.

The ATLAS Preventative Trial uses this marker to identify the best time for patients with the faulty SOD1 gene to begin receiving tofersen infusions.

Macquarie University Hospital is the only site in the Southern Hemisphere to be taking part in the study.

Dominic Rowe is the Foundation Professor of Neurology at Macquarie University, and a Director of the Macquarie University Centre for Motor Neuron Disease Research. He has been treating people with MND for more than 20 years, and is leading the Australian arm of the ATLAS trial.

"The fact that there is now a treatment for even one form of MND is nothing short of miraculous, and it gives us hope for further treatments for other types of MND," Professor Rowe says.

"It represents 30 years of research effort since the SOD1 gene was first implicated in familial MND.

"With only 10 per cent of MND cases being inherited, and 43 different genes responsible for those cases, the number of Australian MND patients with errors on the SOD1 is relatively small.

"The premise of using gene therapies to reduce the gene expression for one gene error will be replicated for other types of MND, and it represents a dramatic intervention for patients.

"Multiple other gene therapies will become available to patients after this."

There is already a study underway for another gene therapy to target MND caused by errors on the c9orf72 gene.

The Macquarie University Centre for MND Research currently has five clinical trials underway, including the world-first trial of the drug 3K3A-APC, which received $1 million in funding from the NSW charity, Firies Climb for MND.

Developed by ZZ Biotech, 3K3A-APC targets sporadic MND and is designed to repair damage to the blood–brain barrier caused by the disease.

Professor Rowe says 3K3A-APC has now passed its first, acute dosing phase, which tests for how safe and well tolerated a drug is.

Later this year, it will enter its second phase, which tests the effect of lower doses over a longer period of time.

The Macquarie University Centre for Motor Neuron Disease Research held its annual gala dinner on Friday, 23 June 2023 to raise funds to further its MND research.

FOR MORE INFORMATION

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Slowed from a waterfall to a trickle

When Lyndall Zinga first felt weakness in her thumb and twinges in her neck, she hoped she had a pinched nerve, but she had a sinking feeling it was something far worse.

Both her mother and grandfather had died from the neurodegenerative disorder MND, and six months after she first noticed a problem, she too received the diagnosis she had dreaded.

"It moves so quickly," Mrs Zinga, now 59, says.

"My mother barely had 12 months from the time she was diagnosed to being gone, so I just thought, 'Well, that's it.'

"I could feel it creeping up my right arm, and within a year of that first twinge, I'd completely lost use of it."

Soon after that, in November 2021, Mrs Zinga received her first monthly infusion of tofersen, the groundbreaking new drug designed to treat inherited MND caused by an error on the SOD1 gene, and the effect has been remarkable.

"It has slowed the progression from a waterfall to a trickle," she says.

"I noticed straight away that some of the aches had gone, and I wasn't feeling as tired. I just wish it had been available when I was first diagnosed, because it might have saved my arm.

"This gives you hope for the future – a chance to keep on living. I have two daughters, and it gives me hope for them, too."

Lyndall Zinga

Retinal gene therapy could provide protection in glaucoma

Dr Nitin Chitranshi, Professor Stuart Graham

Macquarie Medical School researchers have developed a technique for a gene therapy that could help treat the world's leading cause of irreversible blindness.

A treatment that ensures nerve cells in the eye continue to produce a vital protein that protects them from being broken down could help prevent the progression of glaucoma, researchers have found.

Glaucoma is the world's leading cause of irreversible blindness, affecting about 300,000 Australians and more than 70 million people globally. It is associated with gradual vision loss, initially in the periphery but then spreading centrally. The disease damages the optic nerve and the retinal ganglion cells, which are a type of neuron that carry visual information to the brain.

Glaucoma is often associated with increased pressure in the eye. It can be detected during routine vision tests, by measuring the eye pressure or inspecting the optic nerve for damage with special scanners. While any damage already sustained cannot be reversed, in many cases the progression of the disease can be slowed or stopped through treatment to lower the pressure.

However, many patients continue to worsen despite treatment, indicating there are other factors at play in addition to pressure. Professor of Ophthalmology Stuart Graham from Macquarie Medical School is leading a team that is investigating the role of the protein neuroserpin in the disease.

Vision neurobiologist Associate Professor Vivek Gupta says they have found that neuroserpin, which is produced in the connectors between nerve cells, is vital in protecting retinal ganglion cells.

"Other researchers have linked changes in neuroserpin to stroke and neurodegenerative disorders like Alzheimer's and Parkinson's diseases, but our work is the first to relate it to glaucoma," says Professor Gupta.

"Cells naturally break down and are recycled in the body, but when neuroserpin is absent, this process speeds up in the retina.

"Essentially, the body begins to eat away at the retinal ganglion cells and the optic nerve."

Oxidation is a common cause of molecular breakdown in nature. Iron rusting and a cut apple turning brown are both familiar examples. The team has discovered that when neuroserpin oxidises, it loses its protective ability, allowing accelerated cell breakdown. They have also shown that when mice produce more neuroserpin, it has a protective effect, promoting the survival of the retinal ganglion cells and minimising glaucoma damage.

Vision Scientist Dr Nitin Chitranshi says in the latest work, detailed in an article in a recent edition of *Molecular Therapy*, the team has successfully manipulated a gene in mice to produce a version of neuroserpin that is resistant to oxidation.

"When we introduce this gene directly to the eye, it increases the production of neuroserpin in the retina," says Dr Chitranshi.

"We are also working on a way for the protein to give its instructions to produce neuroserpin only to the retinal ganglion cells and not to other neurons, so it can be perfectly targeted."

The team is now preparing for further testing of the enhanced gene and will commence new trials shortly.

Professor Graham says glaucoma is a complex disorder involving a number of mechanisms, not all of which are well understood.

"For this reason, our gene therapy is unlikely to be a silver bullet for all glaucoma, but we have great hopes that it will become a valuable part of treatment for use in conjunction with other therapies, making the nerve cells more resistant to damage," Professor Graham says.

"But we still have a lot of work to do before we can translate this to human studies."

This study was funded by a National Health and Medical Research Council Ideas Grant.

Professor Graham practices as a glaucoma subspecialist, with a special interest in early diagnosis and electrophysiology at MQ Health Ophthalmology.

FOR MORE INFORMATION

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MQ HEALTH CARDIOLOGIST PIONEERS VIRTUAL REALITY TRAINING FOR AN IMPORTANT CARDIOLOGY PROCEDURE

Associate Professor Martin Brown

Launched during the COVID-19 pandemic, virtual reality right heart catheter training has shown itself to be feasible with a short learning curve, and results in improved competence and error rates.

A cardiologist from MQ Health in collaboration with leading virtual reality company, Vantari VR, has established a world-first comprehensive VR training program for a key procedure, right heart catheterisation (RHC).

RHC is the gold standard for assessing patients with pulmonary hypertension. Clinicians require training in this procedure in a safe and scalable environment with minimal risk to patients. MQ Health is one such training centre.

Associate Professor Martin Brown, advanced heart failure and pulmonary hypertension cardiologist at MQ Health, said that during the COVID pandemic, he had to come up with innovative solutions to teach doctors invasive procedures remotely.

"We couldn't have face-to-face simulation training," he said, "so we developed a VR program module for training cardiology registrars.

"We worked with health technology company Vantari VR to design a VRRHC training module based on our current RHC simulation workshops. The aim was to improve training, competency and confidence in this technique with enhanced diagnostic skills and reduction of procedural errors, resulting in increased patient safety."

The proprietary training platform is delivered via a laptop and VR headset. Clinicians perform the VRRHC according to best practice guidelines with dynamic imaging, monitoring and haptic feedback with the guidance from a virtual AI trainer, all while their performance – such as failed steps and proficiency scores – is tracked in real time. Performance results are subsequently visualised in Vantari Connect, the learning management system.

Analysis was conducted on user engagement, experience and retention, as well as targeted learning outcomes such as learning curve, reduction in operating costs, reduction in procedure times due to higher proficiency, improved interpretation and diagnosis.

Preliminary data shows that, after an initial learning curve associated with using VR and the RHC procedure itself, increased experience results in increased completion rates, reduced procedure time and reduced errors.

"We have now held two workshops and will be taking the training interstate to Melbourne, Perth and Brisbane," said Associate Professor Brown. "Last year, we presented the research at the European Society of Cardiology in Barcelona – the largest cardiology conference in the world with over 30,000 delegates – and delivered a poster presentation at the Cardiac Society of Australia and New Zealand on the Gold Coast.

"We have now incorporated VR training into part of our RHC training at MQ Health, with universities and medical schools around the world also using our technology. While VR is used increasingly for medical training in several fields, no one else has yet achieved what we have for RHC."

Dr Nishanth Krishnananthan, Co-CEO of Vantari VR, could not be more excited with the collaboration.

"Partnering with leading healthcare organisation MQ Health and renowned cardiologist Associate Professor Martin Brown has served as a huge stepping stone for Vantari to build world-first VR training solutions for cardiology," he said.

"The VRRHC has been a huge success locally and in the US where clinicians are blown away by the fidelity, physics and dynamic imaging capabilities. The ability to improve patient outcomes by reducing error from these complex procedures – thanks to better training as well as ensuring accessibility for regional and remote healthcare centres – means we can democratise healthcare training and help cardiologists and clinicians no matter where they are. This is our mission at V[illegible]i and a passion for Dr Vijay Paul a[illegible]s founders of the company."

FOR MORE INFORMATION

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Image supplied by contributor.

PHANTOM LIMB PAIN GETS NOVEL TREATMENT

Associate Professor Tillman Boesel, Professor Antonio Di Ieva

In a pioneering procedure, a case of phantom limb pain has been successfully treated with the implant of a high-frequency spinal cord stimulator. The technique is routinely used for chronic neuropathic pain, but not widely known about – including amongst GPs and specialists.

Neurosurgeon Professor Antonio Di Ieva and interventional pain specialist Clinical Associate Professor Tillman Boesel established the Pain Neuromodulation Clinic at MQ Health/Macquarie Neurosurgery, where they are able to treat complex cases either neglected or not treatable elsewhere. The clinic engages innovative procedures to address chronic long-term and intractable pain, including the first cases in the world of brain epidural motor and somatosensory stimulation for complex facial and arm pain.

More than a decade ago, 46-year-old Scott Robinson had a car accident that resulted in both legs being amputated, a spinal cord transection and burns to his body. Left with phantom limb pain, Scott has felt a burning sensation all the way down both legs even though they are no longer there.

“It feels like I have tried just about every treatment there is,” said Scott. “Nothing has helped and I have been left spending a lot of time in my room, often unable to get into my wheelchair. I’ve been on strong medication for years, trying to dull the constant, excruciating pain.

“I heard about Tillman and Antonio through one of my carers, who knew of a case of severe pain that they were able to fix. I decided to go and see them.”

During a long and complex spine operation – that included enlarging and reconstructing the spinal canal – the two doctors implanted a high-frequency spinal cord stimulator that delivers electrical impulses to the spinal cord towards the brain. The new impulses block the faulty ones, overriding the pain. The neuromodulator has successfully cancelled Scott’s limb and ankle pain.

Post-operatively, Scott took time to adjust to the optimal level on the stimulator. Now, almost six months later, he is still pain-free in the target area, his lower ‘limbs’.

“Neuromodulation is done routinely for lower back pain, leg pain and arm pain – we do several cases a month at Macquarie University Hospital,” explained Professor Di Ieva. “It’s the final option, but it seems extremely successful. Scott’s case had a 50 to 60 per cent chance of success because there is not much published about its use in phantom limb cases, but through extraordinary MQ Health teamwork, we managed to help him.

“Phantom limb pain affects between 40 and 80 per cent of amputees, and it is great news that neuromodulation can even be used for this type of pain. We are now trying to extend this innovation to other patients who could benefit.”

While the MQ Health neuromodulation treatment was able to treat Scott’s lower limb phantom pain, Scott is still grappling with additional pain problems that are under the management of other general and plastic surgeons.

“I’m really happy with what Antonio and Tillman have done,” said Scott. “It really helped with the terrible burning I had in the back of the leg. If I didn’t have the other problems, I’d be in my chair every day.”

FOR MORE INFORMATION
T: (02) 9812 3900

A world-first clinical trial of robotic technology that allows doctors to access tiny nodules in the furthest reaches of the lungs is already showing promising results, and it could prove to be a game changer in the early detection of the world's deadliest cancer.

GAME-CHANGING ROBOTIC TECHNOLOGY

Associate Professor Tajalli Saghaie, Professor Alvin Ing

At just 37 and with two children aged five and seven, laboratory technician Cindy Gomez received the chilling news that she had a small growth deep in her right lung.

Cindy's GP suspected she may have had a heart attack due to elevated levels of a protein called creatinine kinase in her blood. While tests found no problems with her heart, they showed a nodule on her lung. Some lung nodules have simple causes like infections and do not require radical treatment, but others are the first sign of lung cancer.

"I had never smoked in my life, and the thought that I might have lung cancer was terrifying," she says.

"Some members of my family smoked, but I had not lived with them for 12 years, since I came to Australia. I am just so thankful that this was discovered early."

While her nodule was tiny, that did not mean the next steps were straightforward. She was told that because of its size and location, it would be very difficult to biopsy.

Traditionally, the only options in cases like hers have been to remove the nodule without a confirmed diagnosis or wait for it to grow big enough to sample.

Cindy had the opportunity to take part in a clinical trial at Macquarie University Hospital, where respiratory physicians Professor Alvin Ing and Associate Professor Tajalli Saghaie are assessing the Noah Medical's Galaxy System™.

This piece of groundbreaking technology was designed specifically to take biopsies from small, hard-to-reach nodules like hers.

Lung cancer killed more than 8600 Australians in 2020. It is the world's leading cause of cancer-related deaths, though it is only the fifth most commonly diagnosed type of cancer.

The main reason for this high mortality rate is that by the time someone with lung cancer begins to notice symptoms, the disease is well advanced and it may already be too late for treatment.

An early diagnosis is the best chance of beating the disease, but in cases like Cindy's, getting that diagnosis can be challenging, even for the most skilled clinicians.

Professor Ing is one of Australia's leading interventional pulmonologists, and chief investigator in the clinical trial.

"Traditionally, biopsies of lung nodules have been performed via a needle through the chest wall and into the lung, but this carries the risk of significant complications, with the possibility that it could cause the lung to collapse or resulting in bleeding that can be very hard to control.

"A standard bronchoscopy is also an option, but in cases where the nodule is very small and deep in the lung, where the airways are narrowest, it can be difficult to reach and hard to accurately sample, so it tends to result in a successful diagnosis in less than 70 per cent of cases."

Cindy Gomez

The Galaxy System™ uses data from CT scans of the patient's lungs to create a highly detailed GPS style map to the nodule.

During the procedure, a probe is inserted into the airway, and with the assistance of the robotic arm, the doctor uses an Xbox-style controller to follow the map straight to the nodule.

Sweeps from a C-arm X-ray machine confirm in real time that the probe is correctly placed, and the robotic arm holds it steady while samples are collected.

So far, the team including Professor Ing, Associate Professor Jonathan Williamson and Associate Professor Saghaie have completed 18 procedures out of a planned 30, as part of the trial, which is being run by the Macquarie University Clinical Trials Unit.

Associate Professor Saghaie has performed several of the procedures, and says the potential benefits to patients of safer, more accurate sampling methods are tremendous.

"In Cindy's case, receiving that early diagnosis of lung cancer with early effective treatment very probably saved her life," he says.

"She has had the nodule removed, and while she will still need regular monitoring, all of her latest test results indicate she is cancer free.

"If the nodule had gone undetected, she may only have had a few years."

It's still early days for robotically assisted bronchoscopies, but Professor Ing and Associate Professor Saghaie have achieved a diagnosis for every patient who has undergone the procedure.

And it is bringing benefits not only for people who are found to have cancer, but for those whose nodules have other causes.

Four of the people who have been part of the trial have had non-cancerous conditions that either did not require surgery, or required far less radical intervention than would otherwise have been the case.

Currently, one of the key ways of catching lung cancer early is purely incidental: lung nodules are spotted when people have chest scans for other reasons, as in Cindy's case.

Countries such as the UK, USA, Canada, France and Germany have established routine screening programs to provide regular scans for people at high risk of lung cancer due to their current or past smoking behaviour.

On 2 May 2023, the Minister for Health and Aged Care, the Hon Mark Butler MP, announced government investment of $263.8 million from 2023–24 to implement a National Lung Cancer Screening Program similar to the programs already in place for breast, bowel and cervical cancer.

If such a program were to be established, then far more small nodules would be discovered, and more accurate sampling methods, such as robotically assisted bronchoscopies, would be in high demand.

But robotically assisted bronchoscopy is not the answer in every case, and it should not be performed without proper consideration from a multidisciplinary team.

Macquarie University Hospital's MQ Health Respiratory and Sleep Clinic established a pulmonary nodule clinic last year, with a team that includes interventional pulmonologists like Ing and Saghaie, who work with cardiothoracic surgeons, radiologists and oncologists.

"Just because you can do a bronchoscopy, that doesn't mean it's the most appropriate thing for every patient," Professor Ing says.

"Some patients will go straight to surgery because the mass in their lung is growing quickly, with other tests suggesting lung cancer, while others will need radiotherapy because they are too frail for general anaesthetic and surgery.

"It's very important that all the patient's circumstances are taken into consideration on an individual basis, and this is where the multidisciplinary team approach really comes into its own."

FOR MORE INFORMATION
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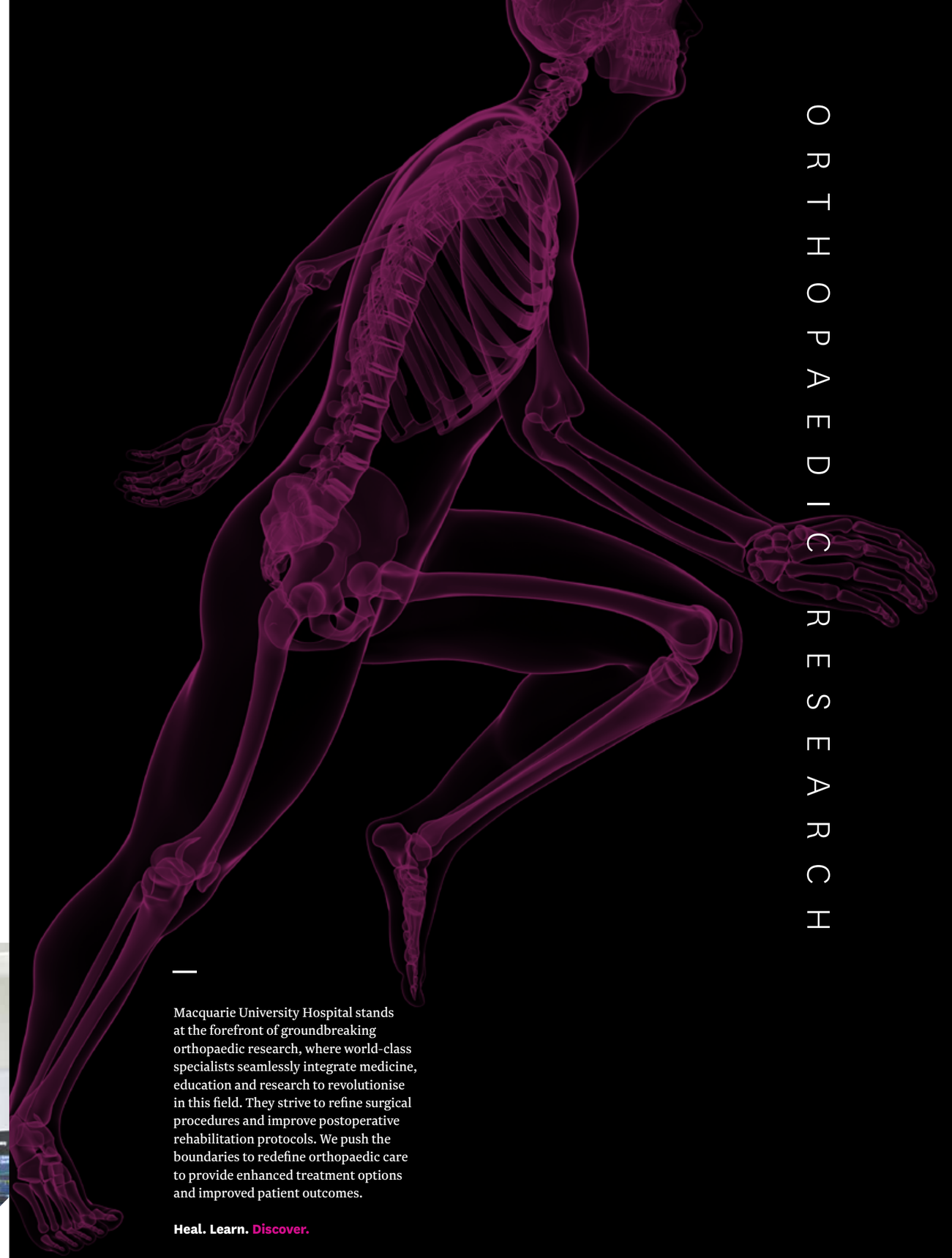
Associate Professor Tajalli Saghaie, Eli Sigman (Noah Medical)



ORTHOPAEDIC RESEARCH

Macquarie University Hospital stands at the forefront of groundbreaking orthopaedic research, where world-class specialists seamlessly integrate medicine, education and research to revolutionise in this field. They strive to refine surgical procedures and improve postoperative rehabilitation protocols. We push the boundaries to redefine orthopaedic care to provide enhanced treatment options and improved patient outcomes.

Heal. Learn. Discover.

Spine surgeons and patients benefit from 7D navigation

Dr Brian Hsu

Macquarie University Hospital surgeons have access to FLASH™ Navigation, an intraoperative system that provides a safe, radiation-free surgical environment for patients and a fast, accurate and more efficient workflow for surgeons.

Spine surgeons who perform complex spinal surgery and deformity surgery at Macquarie University Hospital are using an advanced image guidance system that offers significant intra-operative assistance when performing long and complex procedures.

Camera-based technology coupled with machine-vision algorithms allows FLASH™ Navigation to use multiple light sources and advanced sensors to map and visualise a patient's surface anatomy in just seconds.

"As an enabling technology, 7D is advantageous with certain aspects of surgery," said Dr Brian Hsu, Adult and Paediatric Spine Surgeon at Macquarie University Hospital who has a particular interest in spinal deformity, complex cervical reconstructions, spinal osteotomies and degenerative cervical and lumbar conditions.

"The rapidly produced 3D images enable us to see where we are within the anatomy, and within the bone. The 7D device guides with relative ease and collects the topographical detail needed which is very useful to the surgeon – and also the patient, who benefits from a shorter overall operating time.

"Older style navigation systems and robotic systems require the surgeon to follow a more convoluted process, placing markers and imaging under CT imaging for each and every segment. This is a significant dose of radiation for the patient and can result in an extended time under general anaesthetic."

While similar to an intraoperative CT, FLASH™ Navigation does not use radiation and the images it produces are compared to a preoperative CT scan. A typical spinal fusion for a paediatric scoliosis patient requires instrumentation to 10 vertebral segments of the spine, with the insertion of up to 20 pedicle screws. This procedure typically takes approximately four hours of surgical time, benefiting the patient with less anaesthetic time and reduced blood loss during surgery.

Dr Hsu is an active member of the Scoliosis Research Society, North American Spine Society, the American Academy of Orthopaedic Surgeons and an officer of the AO Spine Asia Pacific. He is a member of the Society of Minimally Invasive Spine Surgery and a Fellow of the Hong Kong Academy of Medicine. Dr Hsu is actively engaged in teaching and education locally and internationally and currently supervises a group of Spine Fellows at Macquarie University and the Children's Hospital at Westmead. Dr Hsu regularly teaches advanced bioskills workshops and presides over a number of educational conferences.

FOR MORE INFORMATION
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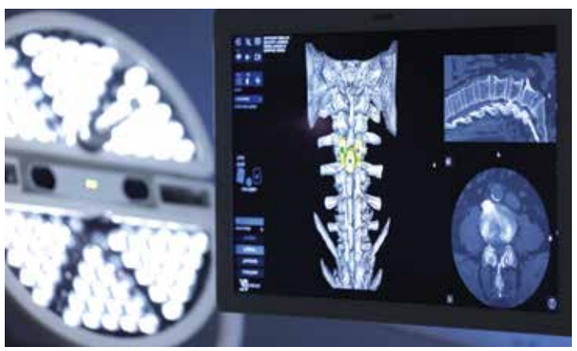


Image supplied by LifeHealthcare

Clinical trial:

TREATMENT PROVIDES LASTING RELIEF FROM BACK PAIN

A new treatment could revolutionise the way we manage chronic back pain, and researchers are now investigating how to train physiotherapists to make it widely available.

A clinical trial of a personalised treatment method to help people to better understand their back pain and take charge of its management found lasting benefits well after treatment was complete.

About one in six Australians report chronic lower back pain. It is the leading cause of disability worldwide, contributing to reduced physical and mental health and a loss of productivity, and it is a common driver of early retirement.

While most people who suffer from episodes of lower back pain recover quickly, about 20 to 30 per cent have long-term pain lasting three months or more.

Cognitive functional therapy (CFT) uses intensive personalised sessions with specially trained physiotherapists to help people to develop a positive mindset about their pain and body, learn to move in ways that ease their pain to regain confidence, and make lifestyle changes.

This resulted in less pain-related anxiety and giving them the knowledge and confidence to do things they have been avoiding or are fearful of.

CFT was developed by Professor Peter O'Sullivan from the Curtin School of Allied Health and colleagues around the world. A team led by researchers from Curtin University and Macquarie University has now published the findings of a study into its benefits in the latest edition of respected medical journal *The Lancet*.

Traditional approaches to managing chronic back pain include surgical interventions, massage, spinal manipulation, injections, and medications, but these typically produce small and short-lasting benefit. Importantly, none of these treatments address the range of factors contributing to pain.

One of the key differences with CFT is that the treatment is tailored to the individual, taking into account their concerns and limitations of movement.

Professor Mark Hancock

The RESTORE study

Nearly 500 people in Sydney and Perth took part in the study, which involved a randomised, controlled clinical trial across 20 physiotherapy clinics. Participants were divided into groups receiving CFT or whatever type of traditional care was recommended by their clinician.

To take part in the study, participants had to have had lower back pain for at least three months. The people who took part had been living with back pain for an average of four years, and many had high levels of disability due to their condition.

The people receiving CFT attended seven personalised CFT sessions over 12 weeks, followed by a booster session after six months.

Macquarie University Professor of Physiotherapy Mark Hancock led the trial in Sydney, in collaboration with the project lead Associate Professor Peter Kent from Curtin University.

"More than 80 per cent of the participants who received CFT reported they were satisfied with their treatment and its outcomes," Professor Hancock says.

"They reported significant improvement in pain levels, and being able to return to activities they had previously enjoyed.

"One of the most significant aspects of this trial is that the CFT participants were still reporting reduced pain and improved function 12 months later.

"Some people who we've had contact with following the study have told us they are still reaping the benefits three years later."

Leah Fitzgerald

A different approach to pain

Ten years ago, when she was just 29, Leah Fitzgerald developed severe back pain that turned out to be a herniated disk.

"For me, it came out of nowhere, and it's been a journey ever since of trying to prevent and manage pain," Leah says.

"To begin with, I would get regular treatment from an osteopath, and I tried lots of things like acupuncture, alternative medicine, massage, using a standing desk and heat-pack treatment.

"Sitting upright for long periods was the most painful for me, so I dreaded long flights and car trips, and would spend time worrying about them and preparing for them.

"Every few years, I'd have a severe flare-up and need to take strong painkillers for a day or two, take some time off my usual activities and then gradually return to them."

Leah had always been active, and she noticed that the fitter and stronger she was, the fewer problems she had with her back. But doctors had warned her to avoid certain activities and movements, and she became anxious about everyday actions like sitting at her office desk, running, bending down, and lifting heavy items.

After joining the CFT trial, she noticed improvement within two to three months. Four years later, she is still enjoying the benefits.

"The psychological aspect for me was the biggest thing," Leah says.

"Pain is not all in your mind – you have a real diagnosis – but CFT taught me to think about pain differently, but also to feel less anxious and have more confidence in the way I move.

"Before the treatment, when I had to bend down, I'd tense up because I was pre-empting the pain. I learnt that this mindset was actually putting me at more risk of aggravating the injury.

"I learnt that just by relaxing, breathing the right way and moving correctly, I can protect my back and feel less pain.

"Most importantly, I am not afraid to be active. My perspective has changed now that I'm not anticipating hurting myself or being in pain."

While she does still get some pain, it has been reduced significantly. She has been able to start running again and can even do deadlifts at the gym.

Making CFT more widely available

At this stage, only the 18 physiotherapists in Sydney and Perth who were trained for the RESTORE study, and some of the developers of the approach, are qualified to provide CFT to patients, but the team is investigating ways to scale up training, with a view to establishing a hybrid online/in-person learning model.

Professor Hancock says it is very important for the training to be comprehensive and competency based.

"We noticed it took quite a lot of training for physiotherapists to develop the skills and confidence to deliver the intervention at a high standard, despite the fact that many were already experienced," he says.

"I'm teaching the principles of CFT as part of Macquarie University's Doctor of Physiotherapy program, but it's complex, and I don't expect students to achieve full competency by graduation.

"We are looking forward to being able to make this treatment widely available, not only in Australia but around the world."

The RESTORE study was led by researchers from Curtin University and Macquarie University, in partnership with Monash University, the University of Limerick, Imperial College London, the University of Southern Denmark, and the University of Western Australia. It was funded by the National Health and Medical Research Council and Curtin University.

Professor Mark Hancock is a Professor of Physiotherapy in the Macquarie University Faculty of Medicine, Health and Human Science.

FOR MORE INFORMATION
restorebackpain.com

Revolutionising orthopaedic care with cutting-edge research

Associate Professor Sam Adie

Macquarie University Hospital is currently undertaking a groundbreaking initiative, colloquially known as the 'Level 5' project, which involves the establishment of a world-class orthopaedic centre within the hospital premises. The new unit will offer a broad range of services and importantly, will embed research into both concept and clinical practice.

Orthopaedic surgeon Associate Professor Sam Adie recently joined Macquarie University Hospital. He performs hip and knee replacement surgery – including some cases as part of the hospital's No-Gap Joint Replacement Program. He says that research is crucial to offering the best clinical practice to patients and to Macquarie University Hospital being a leader in orthopaedics.

"In my view, you can't be a world-class centre without doing research," said Associate Professor Adie, who also specialises in arthroscopic, or keyhole, surgery. "Research contributes to better practice because when you generate high-level data, you can have discussions as to whether your practice is the best it can be. Using evidence means better outcomes for patients.

"We also know that patients who actually participate in research studies have better outcomes. With Macquarie's Level 5 project enabling us to become a high-volume centre with well-regarded surgeons, nurses and allied health professionals – all adjacent to a University and a Clinical Trials Unit – we are well placed to do high-level research into the future."

Associate Professor Adie's research is focused on these large trials, mostly randomised control trials and systematic reviews. A collaborator on many national and international research studies – three of which are summarised below – his overall focus is better understanding the adverse effects of surgery and how to improve outcomes.

Associate Professor Adie will bring his research expertise to the new orthopaedic unit where the team will follow an evidence-based enhanced recovery after surgery (ERAS) model, which sees patients participate in significant pre-admission and post-operative education to ensure they are actively involved in their rehabilitation and can return to independent living as quickly as possible.

The CRISTAL Trial

The CRISTAL Trial is almost certainly the largest orthopaedic trial ever conducted in Australia. Funded by the Medical Research Futures Fund and led by Professor Ian Harris and Dr Verinder Sidhu, it involved 31 hospitals, and was recently published in *JAMA*. The trial addresses the question of whether aspirin or Clexane is more effective in preventing venous thromboembolism within 90 days following primary total hip or knee arthroplasty performed for osteoarthritis.

"This question is a source of patient anxiety and surgeon concern, because these two agents are used a lot," explained Associate Professor Adie. "There has been a general preference for aspirin as it's more convenient to take and was thought to cause fewer bleeding complications.

"We did a large multi-centre, registry-nested trial including about 10,000 patients – the first of its kind. We found Clexane to be more effective in reducing clots, without additional adverse effects. Given preconceptions about aspirin, this trial was important. It's a great example of a big trial that can be conducted when we work together."

The DISTINCT Trial

This trial looks at dual mobility versus standard total hip arthroplasty (THA) in femoral neck fractures. It, too, is a registry-nested, cluster-randomised control trial.

"We know that outcomes after hip replacement for fractured femoral neck are worse than those for standard osteoarthritis," Associate Professor Adie explained. "We are looking at the main risk, which is prosthesis dislocation. As one of the most feared outcomes, it's anxiety-inducing for patients."

The DISTINCT Trial compares conventional THA with dual-mobility THA, which in theory should reduce the instability risk.

Opioid-HALT Trial

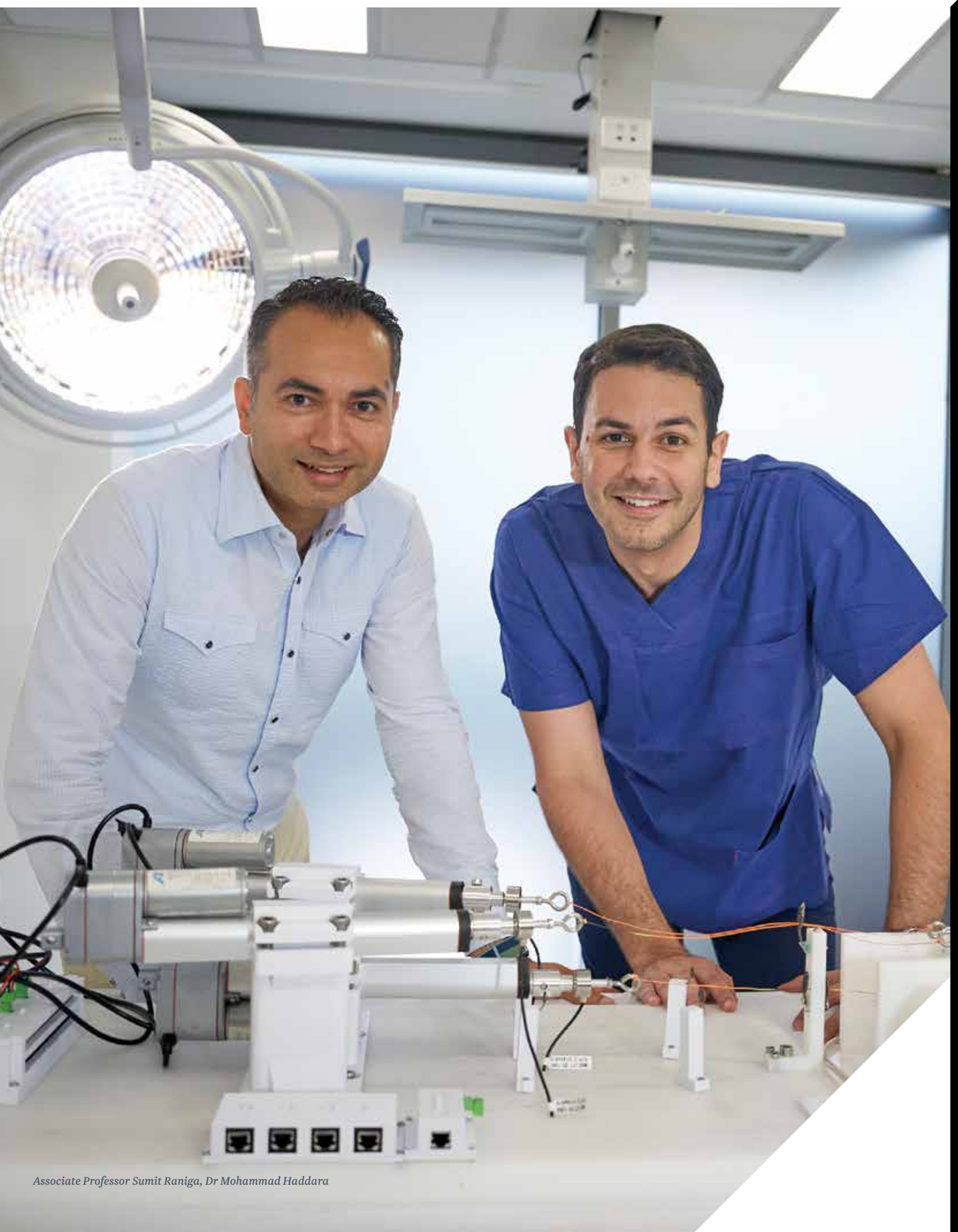
The Opioid-HALT Trial deals with another major issue for joint replacement: the prolonged use of opioids for chronic pain before surgery. Between 30 and 40 per cent of people waiting for joint replacement procedures are using opioids over the long term.

"Opioid use can be disastrous, leading to poor long-term health outcomes as well as poor joint replacement outcomes," said Associate Professor Adie. "The goal of this trial is to replace opioid use in patients waiting for joint replacement surgery through an opioid-tapering program of pain relief that is led by a clinical pharmacist.

"The study is unique in that pharmacists – not specialists – are leading the intervention that is being compared to standard care via a GP or no pain relief at all. This should be a game changing study."

Based on the successful pilot in New South Wales, the team has secured a $1 million NHMRC grant that will extend the study interstate.

FOR MORE INFORMATION
T: (02) 9587 4720



Associate Professor Sumit Raniga, Dr Mohammad Haddara

FINGER SIMULATOR ENHANCES SURGICAL UNDERSTANDING

A postdoctoral fellow at the MQ Health Translational Orthopaedics Research Lab has developed an advanced hand simulator that mimics the delicate joint movements of the fingers so accurately that it will enable researchers to explore aspects of finger injuries and treatments that no other studies have explored in the past.

Biomechanical engineer Dr Mohammad Haddara – currently a postdoctoral fellow at MQ Health – has developed an intricate and sophisticated cadaveric finger motion simulator that will offer unprecedented assistance to surgeons in understanding and treating hand injuries.

Using advanced mechatronic technology, the hand simulator moves a cadaveric hand in a way that mimics true physiological and in-vivo movements of the finger, with the ability to simultaneously measure biomechanical data.

Working in the MQ Health Translational Orthopaedics Lab – established by surgeon scientist Associate Professor Sumit Raniga – alongside biomechanical engineer and researcher Associate Professor Richard Appleyard, Dr Haddara is further enhancing the simulator he developed for his Master of Biomedical Engineering at Western University in Canada, under the supervision of Associate Professor Louis Ferreira. Dr Haddara's PhD also advanced the simulator, incorporating finer actuator tuning, motion algorithms and a novel tracking system.

"What we see in current motion simulators is that very few researchers choose to focus on finger segments because they are so small and fragile that it is challenging to mimic subtle, yet fine, movements," said Dr Haddara.

"There are, however, a lot of questions that arise during surgery about these delicate structures and these gaps in the literature were the driver for designing the simulator. We are now able to provide clinics and hand therapists with the capability to learn about the internal biomechanics of the finger and explore different repair techniques to provide a much better quality of life for future patients.

"The environment at MQ Health Translational Research Program is excellent for furthering this kind of project because of the input from specialist orthopaedic surgeon scientists and their clinical questions. Important equipment such as the C-arm that we have here allows me to capture scans while the finger is moving. This is something unique to the lab here and one of the reasons I chose to come to MQ Health."

Many current simulators use hanging known weights over a pulley system to apply load to the different tendons and structures. However, these tend to lack the ability to properly dictate the excursion of the tendon throughout the motion. The actuators Dr Haddara has developed move the fingers more actively – using long motorised shafts – to achieve a truer motion while constantly measuring tendon excursion and load through means of feedback control from the actuator.

The simulator also has a unique joint tracking system that incorporates the use of minute 2mm electro-magnetic trackers in each finger segment of interest for accurate motion tracking in all three motion planes. Such highly complex data is captured through 3D motion capture software called The Motion Monitor.

"I have also created software using Arduino that directly communicates to a control circuit board I designed," explained Dr Haddara. "So while the idea of actuation is not new, many of the current simulators have until now used a 'passive' assisted-motion approach – a combination of actuator and a known weight. Our version, by comparison, is fully active.

"The primary goal of my work is always to increase quality of life for patients after injury. The finger is very fragile and very complex. The actuator will give surgeons and hand therapists the opportunity to test the biomechanics of standard surgical techniques but, more importantly, explore and develop new techniques and test them."

Dr Haddara and his team have several studies under way. One recent example is a study that incorporates the use of custom-designed thermoplastic splints used by hand therapists as an exercise tool to assist the middle finger joint – the proximal interphalangeal joint – in motion. With such a simulator, the researchers are capable of mimicking true active finger motion with the incorporation of different splints to understand the biomechanical effects that they have on joint kinematics and torque transmission from one joint to another. Results will be valuable for many hand therapists as such splints are used today with little to no biomechanical understanding of how they work.

The team also recently published a study addressing a condition that rock climbers experience when they induce a tear to their pulley mechanism, causing the tendon to move away from its centre of rotation and, therefore, limiting joint motion. Similar thermoplastic rings were designed for each specimen individually and applied as 'external' pulleys to alleviate any stresses on the repaired pulley during rehabilitation. The technique has been found to be successful and other surgeons seem to be adopting it.

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Australia could soon be supplying the world with a uniquely strong, long-lasting and readily available replacement for damaged ligaments: kangaroo tendons.

Kangaroos could revolutionise treatment

FOR COMMON KNEE INJURY

Dr Nick Hartnell

Few injuries strike fear into an athlete's heart like a ruptured anterior cruciate ligament (ACL).

Requiring reconstructive surgery followed by months of rehabilitation, an ACL rupture can mean the end of a season, or even a career.

The ACL is a major ligament in the knee, hinging the femur to the tibia. Injuries are common in sports such as AFL and soccer, where players change direction quickly or pivot after landing from a jump.

One of the key problems with serious ligament and tendon injuries is that the damaged tissue cannot simply be sewn back together. It has to be replaced with something the body can use as a type of scaffolding as it weaves replacement tissue over the top.

There are currently only two options for reconstruction, but neither of them is ideal.

This is where orthopaedic surgeon Dr Nick Hartnell hopes to soon be able to offer a better, stronger replacement ligament – and change current medical thinking in the process.

Building a better ACL

Tendons and ligaments are similar connective structures found throughout the body, including the knees, shoulders, elbows, ankles and wrists. Ligaments join bones together and stabilise the joints, while tendons help various body parts to move.

In Australia, 90 per cent of ACL replacements are done using a tendon taken from elsewhere in the patient's body, such as a hamstring or a patella tendon. This inevitably adds to the pain and rehabilitation period, as the patient now has two surgical wounds to recover from and the donor site can be weakened by the loss.

"In addition to this, up to a quarter of all ACL reconstructions fail," Dr Hartnell says. "If that happens, or the person has damaged two ligaments at once, or they are injured a second time, they are running out of options.

"The other 10 per cent of replacements in Australia – and up to 50 per cent in the US – are done using ligaments and tendons from people who have chosen to donate their bodies after death.

"There is a very limited supply of these cadaveric tendons available, and unfortunately the strength tends not to be as good as we would like, leaving the patient with a weaker knee.

"Xenografts – using tendons from other species – have the potential to be a better option, but so far medicine has struggled both to find a suitable donor species that has strong, durable tendons that will not be rejected."

Xenografts are already common in other types of surgery, such as replacing heart valves with those from pigs, but many such transplants require genetic changes to the donor animal in order to be successful.

Research teams overseas have been experimenting with tendons from cows and pigs, and their progress is being closely watched by sporting leagues where ligament injuries are costing clubs and players millions in lost earnings every season.

Inspiration for change

For the past 15 years, Dr Hartnell has been practicing in Bowral, a leafy town in NSW's idyllic Southern Highlands, 120 kilometres from central Sydney. Weekends and holidays have been spent at the family property on the state's South Coast, where wild kangaroos are plentiful.

"I've always said that kangaroos are nature's greatest athletes," he says.

"They really are the most impressive animals – they can jump lengths of up to 12 metres, clear a three-metre fence and hop at 70 kilometres an hour.

"Watching them in action, I started to wonder how much of this athletic ability was related to the way their tendons were formed, and whether they might be used to replace ruptured human ligaments."

While he had been toying with the idea for a while, it was not until he had to operate on his teenage daughter's friend 10 years ago that he began his research in earnest.

"She had ruptured her ACL while skiing, and we had to take her hamstring to replace it," he says.

"I came out of that theatre thinking I didn't want to have to put kids through that anymore.

"That was the time I really committed myself to finding a better solution."

Stronger and more durable

It was important to Dr Hartnell that no kangaroos were killed expressly for his research, and this has remained his practice all through his investigations: all of the work has been done only using kangaroos that have either been culled for reasons of population control or harvested for meat.

The first step in his investigations was to acquire a dead kangaroo from a local farmer who had been culling, then remove the tendons and send them away for testing.

"I was expecting them to be great, but those initial tests showed they were even better than I could have hoped," he says.

"We have found they are up to six time stronger than human tendons, and they are just the greatest thing you could want when you're reconstructing connective tissue.

"They are biologically superior as far as tendons are concerned, and currently all of that potential is just being wasted because the tendons aren't being used for anything."

Dr Hartnell and his team have thoroughly investigated the characteristics of kangaroo tendons, including which limbs offer the best option for different human ligaments, and compared them to the existing options for ligament replacements.

They have also developed a way of ensuring the kangaroo xenografts are not rejected after transplant. The key to this is what he describes as "the special sauce", and it is a closely guarded secret that has already been patented.

Their findings so far give every reason to believe that not only will kangaroo tendons not be rejected, but that they will also be stronger and more durable than any other graft option currently available.

As well as making repeat injuries less likely, Dr Hartnell believes this extra strength will slash the rehabilitation time, allowing players to return to the field or court more quickly than before.

And with the limited nature of the average sporting career, this would be tremendously exciting news for athletes and clubs alike.

"Our aim is to produce a range of products to repair damaged ligaments that would be readily available and have a long shelf-life," he says.

"We are working towards it being as easy as the surgeon simply selecting the right packet of kangaroo tendons before an operation.

"Australia could easily meet the entire world's need for ligament reconstruction using tendons from the kangaroos that are already being harvested for meat.

"It's a huge potential benefit from an existing resource that is currently just being thrown away."

The team are now in the final stages of pre-clinical trials, and they hope to be able to begin the first human clinical trials in 2024.

"Every orthopaedic surgeon I've spoken to about this has said they want to use kangaroo tendons as soon as they become available," Dr Hartnell says.

"I think this work has the potential to change how orthopaedic surgeons think. I know it's changed how I think."

FOR MORE INFORMATION

T: (02) 4861 6698

This year's MND Gala Dinner at the Art Gallery of NSW raised $125,000 for vital research at the Macquarie University Motor Neuron Disease Research Centre.

Three hundred guests attended a sit-down dinner on 23 June, which included a private viewing of the 2023 Archibald, Wynne and Sulman Prizes exhibition.

MND GALA DINNER

INTERNATIONAL

NURSES DAY

OUR NURSES. OUR FUTURE.

On 12 May 2023, our wonderful nurses came together to celebrate International Nurses Day. With unwavering dedication, compassion and expertise, our nurses consistently provide exceptional care to our patients. The nurses at Macquarie University Hospital embody the true essence of nursing, going above and beyond. We celebrated with a barbeque, Annual Nursing Awards and bed-making competition.

Macquarie University Hospital No-Gap Joint Replacement Program

Find out more at **mqhealth.org.au/no-gap-partnerships**

Terms and conditions apply. The HCF and Macquarie University Hospital No-Gap Joint Replacement Program is proposed to end on 30 September 2023 at Macquarie University Hospital for HCF members.

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