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MURMURS®

SMALLER DEVICES SMALLER CUTS

NHCS PERFORMS ASIA'S FIRST MINIMALLY INVASIVE LVAD IMPLANTATION

PULMONARY ARTERIAL HYPERTENSION HITS WOMEN IN THEIR 30s AND 40s

NHCS NURSES SHINE THE LIGHT ON BETTER SLEEP FOR PATIENTS

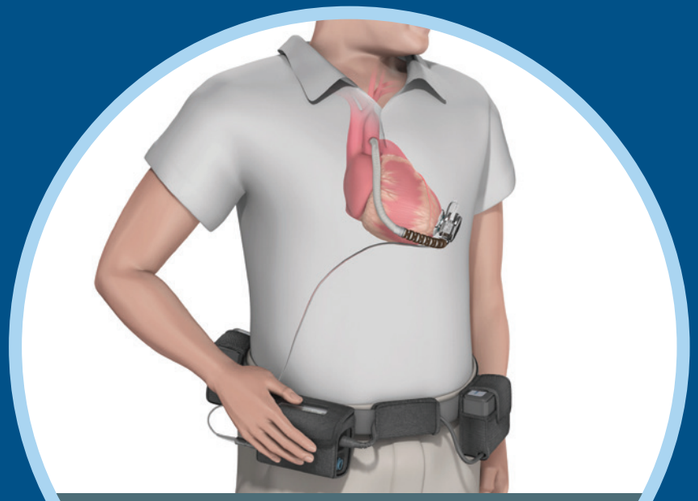
ONE TEST FOR 17 INHERITED CARDIAC CONDITIONS

NHCS CARDIOLOGIST RETURNS FROM THREE-YEAR RESEARCH IMMERSION IN EDINBURGH

WHAT HEART PATIENTS CAN EXPECT FROM MEDISHIELD LIFE

SMALLER DEVICES, SMALLER CUTS

NHCS PERFORMS MINIMALLY INVASIVE SURGERY TO IMPLANT HEART ASSIST DEVICE



The HeartWare ventricular assist device is implanted right next to a patient's heart and connected to an external controller and batteries to help the heart pump blood around the body.

Image courtesy of HeartWare, Inc.

Adj Asst Prof Soon Jia Lin (right), Consultant, Department of Cardiothoracic Surgery, NHCS, explains the mechanics of the heart assist device to Mr Lek Kwang San.

Mr Lek Kwang San is a little different from most patients who have had a heart assist device implanted.

While others have a long surgical scar running down the centre of the chest, he has two shorter ones – one below the midpoint between the collarbones, and another under the left breast.

Mr Lek is Asia's first patient to undergo a heart assist device implantation surgery via the minimally invasive method at the National Heart Centre Singapore (NHCS). He underwent the three-hour surgery on 24 September 2014, and was able to walk and start on his physiotherapy exercises the following day.

"Now I feel better, and I don't feel so breathless when walking and I can climb the stairs," said the 47-year-old fulltime volunteer, "I even managed to make a trip to Ipoh in April."

Five months after his minimally invasive surgery, Mr Lek was able to walk more than 500 metres in six minutes, as part of a standard test to assess the functional capacity of heart patients before and after their surgery at regular intervals. Before the surgery, he was only able to walk 300 metres for the test.

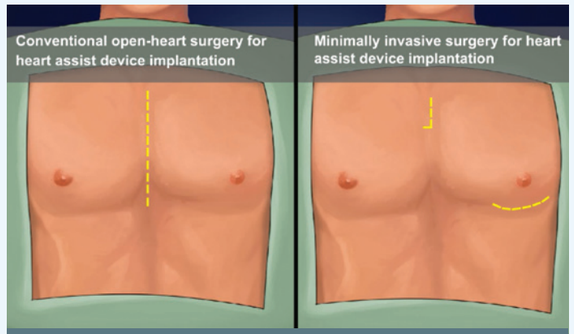
Minimally invasive approach makes repeat surgery easier

Conventional open-heart surgery to implant a heart assist device or transplant a donor heart involves making a long incision down the chest to split the sternum, also known as the breastbone, to access the patient's heart. The incision lengths in the minimally invasive approach vary from 6cm to 8cm according to the patient's anatomy. As the sternum is kept largely intact in the latter approach, it makes open-heart surgery easier when the patient undergoes heart transplantation in future.

Other potential benefits of the minimally invasive surgery include the shortened use of a heart-lung machine to temporarily take over the function of the heart and lungs during surgery to maintain blood and oxygen circulation in the body. Prolonged use of the machine may have negative effects on multiple organs.

"The minimally invasive approach also potentially minimises blood transfusions during surgery," said Adj Asst Prof Soon Jia Lin, Department of Cardiothoracic Surgery, NHCS. Multiple blood transfusions may sensitise patients which can affect the matching of a donor heart for subsequent heart transplantation.

He added: "The NHCS medical team will carefully assess the suitability of patients for this new minimally invasive approach, which will be even more amenable with the next generation of micro heart pumps."



In conventional open-heart surgery (left), a long cut is made on the chest to split the breastbone and implant the heart assist device. The incision lengths in the minimally invasive approach (right) vary according to the patient's anatomy but they will be comparatively shorter than that in conventional surgery.

Prolonging patient survival with heart assist devices

In 2002, Mr Lek was diagnosed with dilated cardiomyopathy – a common cause of heart failure where the heart muscle becomes weakened, stretched and unable to pump blood properly. His condition worsened in 2014 and he was hospitalised three times within the year for heart failure symptoms, which include fatigue, lethargy and shortness of breath.

Before undergoing the surgery, Mr Lek's heart was functioning at 16 per cent, significantly weaker than a normal heart which functions at at least 50 per cent.

Heart transplantation is the definitive treatment for advanced heart failure patients like Mr Lek, but suitable donor hearts are scarce in Singapore. NHCS, Singapore's sole designated centre for heart and lung transplantations, performs an average of three heart transplant surgeries each year.

Adj Asst Prof David Sim, Consultant, Department of Cardiology and Director, Heart Failure Programme, NHCS explained the importance of heart assist devices for patients waiting for a heart transplant surgery, "A heart assist device helps patients with advanced heart failure by prolonging their survival and improving their quality of life by relieving the symptoms. This group of patients have a 12-month survival rate of less than 50 per cent when treated with medications alone."

Mr Lek has a golf ball-sized heart assist device known as the HeartWare ventricular assist device implanted right next to his heart and connected to an external controller and batteries to help the heart pump blood around the body. With the device implanted, Mr Lek's native heart gets to rest and is now functioning at around 25 per cent on its own. Since 2009, the multidisciplinary team at NHCS has implanted more than 56 newer generation heart assist devices.

BENDING LIGHT FOR A GOOD NIGHT'S REST

NHCS NURSES FIND WAYS TO HELP PATIENTS SLEEP BETTER

How well do hospitalised patients sleep at night?

This was the question that brought together a team of nurses at the National Heart Centre Singapore (NHCS), and eventually led them to emerge in the top five winning teams with a Gold Award at the IQC Team Excellence Symposium.

While it is expected that the unfamiliar surroundings or a medical procedure scheduled the next morning might keep anxious patients awake, the team found something else was affecting their sleep.

Disruptive but necessary

In a survey done in August 2014, 33 out of 50 patients staying at one of NHCS' wards cited that insufficient sleep was the main cause of their dissatisfaction towards their hospital stay. Of the group, 70 per cent reported glaring lights and noise as the main disturbances.

The findings presented the nurses with a predicament, as the sources of sleep disruption stemmed from nursing routines that are necessary for patient safety. These include pre- and post-procedure checks, taking of blood samples and vital signs, and changing of bed pans.

The team NHCS behind the innovative use of flexible torchlights and redesigned nursing workflow to minimise sleep disruption to hospitalised patients at night: (front row, from left) Staff Nurse Xiao Bing, Acting Senior Nurse Manager Jasmine Lee, Nurse Clinician Wu Wing Yin, Nurse Clinician Siti Fidawati Binte Jasman, (back row, from left) Ms Lay Sock Yee, Principal Enrolled Nurse Abirami D/O Nagarasan and Staff Nurse Mya Sandar Hlang.

"Nurses on the night shift have the delicate task of changing the patients' sleeping position without breaking their sleep," added project co-leader Ms Siti Fidawati Binte Jasman, Nurse Clinician, Coronary Care Unit, NHCS, "Sleeping in the same position for too long will lead to bedsores, which can lead to life-threatening infections in later stages."

Blood-taking is an important routine task performed by nurses to make sure that patients are doing well. At NHCS' Wards 44 and 47B, about 50 blood samples are taken from different patients each night. This has been flagged out as the main patient care activity that most affects slumbering patients, as the light over the patient's bed has to be switched on to facilitate safe and accurate venepuncture.

"We found that patients in adjacent beds will be affected by the light spilling over and penetrating through the curtain," said Ms Wu Wing Yin, Nurse Clinician, Coronary Care Unit, NHCS, and leader of the project team, "But it is impossible for nurses to work under dimmer lighting conditions as that will compromise patient safety."

All you need is light

After months of brainstorming and testing, the team of nurses came up with the innovative idea to attach a battery-powered portable and flexible torchlight to the "Computer on Wheels" – a laptop mounted on a wheeled platform. It is a standard protocol for nurses to push along the "Computer on Wheels" with them whenever they take blood samples from patients. At just three watts, the low intensity torchlight was bright enough for nurses to safely obtain blood samples from patients at night without light penetrating the curtains and disturbing patients in adjacent beds.

Routine checks and patient care activities by nurses were also redesigned to create longer spells of uninterrupted sleep.

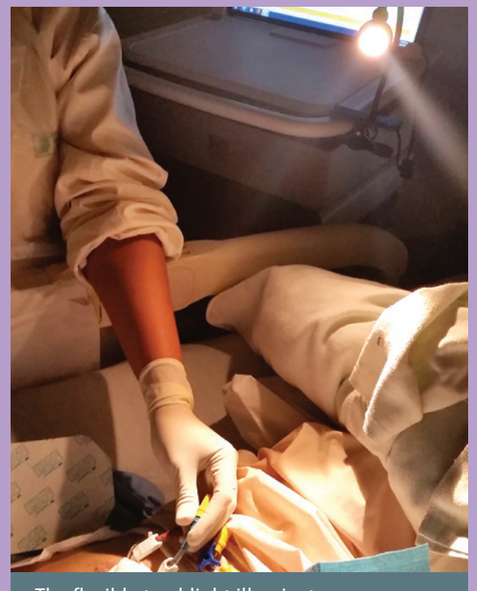
"By safely synchronising the taking of vital signs, electrocardiogram readings and other checks, our redesigned workflow minimises sleep disruption and is more efficient, saving nurses about 9.5 man-hours of work each night," said Ms Jasmine Lee, Acting Senior Nurse Manager, Ward 44, NHCS who was the project facilitator.

The project team's hard work succeeded in raising patient satisfaction on their quality of sleep to about 70 per cent. According to the post-implementation survey done in December 2014, four in five patients reported getting enough sleep at night in the wards after the changes were made to the lighting source and nursing routine.

"We are very happy the flexible torchlight and revised nursing routine help patients sleep better at night, as this will help them recover better as well," said Ms Wu.

The bright overhead lights tend to penetrate the curtains and wake patients in adjacent beds.

The low intensity light from the flexible torchlight will not affect nearby patients.



The flexible torchlight illuminates a small area for nurses to safely draw blood from patients.

CASTING THE NET ON INHERITED HEART DISEASE

NHRIS DEVELOPS COST-EFFECTIVE AND EFFICIENT TOOL FOR RESEARCH IN CARDIAC GENETICS

The National Heart Research Institute Singapore (NHRIS) has collaborated with a leading developer of life science tools and systems to create a new tool that will help research scientists identify mutated genes that cause inherited heart conditions in faster, cheaper and more accurate way.

The TruSight Cardio Sequencing kit was created through the joint efforts of Prof Stuart Cook, Tanoto Foundation Professor in Cardiovascular Medicine, and Illumina, a provider of integrated systems and solutions in genetic research. In consultation with Prof Cook, who is also the Director of NHRIS and Professor of Clinical and Molecular Cardiology at Imperial College London, the development team at Illumina successfully created a kit that works as a fine-toothed comb to sift through 174 genes related to 17 inherited cardiac conditions, ranging from dilated cardiomyopathy to Marfan syndrome.

Finding the cause of inherited cardiac conditions

For a long time, scientists have been searching for the genetic drivers that cause inherited heart conditions. One such condition is sudden cardiac death, which often strikes without warning and with deadly consequences. An estimated one in four cases of sudden cardiac arrest can be traced to a genetic cause.

The 174 genes targeted by the kit were selected based on their genetic relationship to the inherited cardiac conditions, including emerging genes which have been found to be linked to certain conditions but knowledge on the actual mechanisms behind the connection is still incomplete.

"I see the TruSight Cardio Sequencing Gene panel being important because it encompasses all genes known to cause inherited cardiac conditions," said Prof Stuart Cook, "And that's going to be very important in terms of stratified medicine approaches for the future."

Bringing genetic research to speed

The breadth and depth of coverage provided by the TruSight Cardio Sequencing kit gives research scientists another significant boost – speed.

Traditional DNA sequencing methods are limited in scale, scope and potential. Past technology allowed researchers to examine only a few genes at a time, making genetic research costly, time-consuming and laborious. Those constraints also cornered researchers into using their hypothesis as the starting point, and testing only those genes that are related. Unfortunately, the genetic links for disease are often not on a one-to-one basis, and a single condition might be predisposed by a variety of genes.

"Inherited cardiac conditions are not due to a single gene, they are due to multiple genes and multiple large genes. So it is not enough to look at just one of them," explained Prof Cook. Dilated cardiomyopathy, for example, is linked to 59 different genes.

Prof Cook has worked closely with the developers to ensure that the sequencing kit is accurate, sensitive and specific despite the relatively large number of genes covered. With the kit, researchers can have blood samples processed into genetic data for analysis in 24 hours and at a cost of about US$1 per gene.

WHAT IS NORMAL?

NHCS BIOBANK CALLS FOR 5,000 HEALTHY VOLUNTEERS TO ESTABLISH NORMAL BASELINE FOR HEART HEALTH IN SINGAPORE

Volunteers will undergo a 30 to 45-minute magnetic resonance imaging (MRI) scan of the torso and have their blood pressure, body fat and heart rate measured.

Singapore will soon have a better benchmark for heart health.

The National Heart Centre Singapore (NHCS) Biobank aims to recruit 5,000 healthy volunteers over the next five years to help researchers piece together the genetic framework of the average healthy Singaporean.

"We want to understand what is normal in the local population, so that we can really start to deal with what is abnormal," said Prof Stuart Cook, Tanoto Foundation Professor in Cardiovascular Medicine and Director, National Heart Research Institute Singapore (NHRIS). The NHRIS is a research collaboration between the National Heart Centre Singapore and Duke-NUS Graduate Medical School Singapore.

He added that existing research data is largely focused on Caucasian populations, hence what is considered abnormal in Singapore and Asia based on those studies might actually turn out to be normal.

To date, the NHCS Biobank has recruited more 600 healthy volunteers since 2013, on top of heart patients who are seen at NHCS.

What volunteers can expect

Volunteers will have to make a two-hour visit to NHCS on an appointed day and time, where they will answer a detailed questionnaire about their lifestyle, which includes questions on their diet.

On top of having their blood sample taken, volunteers will also undergo a magnetic resonance imaging (MRI) scan of the torso and have their blood pressure, body fat and heart rate measured.

"We will analyse the DNA from the blood samples and the data with the MRI images to understand the local norm, and also the effects of blood pressure, diet and exercise on how the heart and arteries work," said Prof Cook, "Our long term aim is to combine all these data together and enable us to better treat patients."

The donated blood samples and biospecimen can be kept for decades but volunteers can withdraw from the programme any time, after which their blood samples will be destroyed.

Healthy individuals who wish to volunteer can call the NHCS Biobank at 9159 7029 during office hours or email biobanking_enquiries@nhcs.com.sg.

Donated blood samples can be kept for decades but volunteers can withdraw from the NHCS Biobank's programme at any time.

UNDERSTANDING PULMONARY ARTERIAL HYPERTENSION

Pulmonary arterial hypertension (PAH) is a condition of high lung pressure in the pulmonary arteries (pre-capillaries) when:

- Mean pulmonary pressure (mPAP) is ≥ 25 mmHg
- Pulmonary artery wedge pressure (PAWP) is ≤ 15 mmHg and
- Pulmonary vascular resistance (PVR) is > 3 Woods unit

Pulmonary arterial hypertension belongs to Pulmonary Hypertension Group 1 based on the classification schema published in the 2013 5th World Symposium in Pulmonary Hypertension held in NICE. It has several subgroups (see Table 1) such as idiopathic, heritable or familial, related to drugs and toxins or associated with certain conditions such as connective tissue disease, HIV infection, portal hypertension, congenital heart disease or schistosomiasis.

In pulmonary arterial hypertension, the pulmonary arteries become increasingly narrow, restricting blood flow to the lungs and increasing blood pressure in the arteries.

TABLE 1 Updated Classification of Pulmonary Hypertension

1. Pulmonary arterial hypertension

1.1 Idiopathic PAH

1.2 Heritable PAH
- 1.2.1 BMPR2
- 1.2.2 ALK-1, ENG, SMAD9, CAV1, KCNK3
- 1.2.3 Unknown

1.3 Drug and toxin induced

1.4 Associated with:
- 1.4.1 Connective tissue disease
- 1.4.2 HIV infection
- 1.4.3 Portal hypertension
- 1.4.4 Congenital heart diseases
- 1.4.5 Schistosomiasis

1′ Pulmonary veno-occlusive disease and/or pulmonary capillary hemangiomatosis
1″ Persistent pulmonary hypertension of the newborn (PPHN)

Source: Abridged version from Simonneau et al. Classification of Pulmonary Hypertension

Adj Asst Prof Tan Ju Le
Senior Consultant
Department of Cardiology
Director, Adult Congenital Heart Disease
National Heart Centre Singapore

Adj Asst Prof Tan's sub-specialty interests are in adult congenital heart disease, echocardiography, pulmonary hypertension, and cardiac disease and pregnancy.

In PAH, the pulmonary arteries constrict and become increasingly narrow. Progression of the disease is characterised by inflammation and remodeling of the blood vessels. The endothelial cells multiply, the smooth muscle cells increase in size and number and the fibroblast cells multiply. Consequently, the walls of these vessels become thicker and less flexible. This narrowing of the pulmonary arteries restricts blood flow to the lungs and causes an increase in resistance, which causes the blood pressure in the arteries to rise.

Over time, the right ventricle hypertrophies. This explains why the impact of PAH is not limited to the arteries in the lungs but has a direct impact on the heart. In some cases, over a period of time, the right ventricle will start to enlarge and decompensate. As a result, less blood will circulate through the lungs, picking up less oxygen overall. This may make people with PAH feel tired and breathless. If PAH is not treated, the right heart will start to fail.

Signs and Symptoms

The signs and symptoms of pulmonary arterial hypertension are caused by hypoxia, right ventricular failure and decreased left ventricular preload from the lung causing decreased in systemic cardiac output.

Some of the most common symptoms include:

- Shortness of breath during physical or normal activities
- Feeling tired at all times or chronic fatigue
- Dizziness, especially when climbing stairs or prolonged standing
- Chest discomfort
- Palpitations
- Syncope
- Swollen ankles or legs
- Dry cough

Pulmonary arterial hypertension is more common in women aged between 30 and 50 years old, with dizziness, especially when climbing stairs or after prolonged standing, as one of its common symptoms.

PAH can affect any one of any age, sex or race. It is, however, more common in women aged between 30 and 50 years old.

Treating PAH

The treatment options for patients with PAH can be broadly classified into 3 main groups:

- **General measures** include the avoidance of strenuous activities, the avoidance of pregnancy through careful family planning and the use of appropriate contraception, and timely vaccination for influenza and pneumococcus.

- **Supportive measures** include the use of oxygen for patients who require long-term oxygen therapy, the use of diuretics to help relieve organ congestion, and the use of oral anticoagulation to help prevent thromboembolism to the lungs.

- **PAH-specific therapy** mainly targets three main pathways. The first pathway targets the Nitric Oxide Pathway including the synthesis of nitric oxide, as well as the nitric oxide, soluble guanylate cyclase, and cyclic GMP signaling pathway. The drugs in this category include medication such as sildenafil, tadalafil and roiciguat. The second group of medication targets endothelin receptors (e.g. Bosentan) and the final pathway targets the Prostacyclin Pathway which includes drugs such as inhaled iloprost, intravenous prostacyclin etc.

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NHCS PULMONARY HYPERTENSION CLINIC

The pulmonary hypertension clinic is a monthly clinic jointly run by cardiologists from the National Heart Centre Singapore (NHCS) together with respiratory physicians and rheumatologists from the Singapore General Hospital (SGH) with the assistance of trained and specialised pulmonary hypertension nurses. The pulmonary hypertension clinic provides comprehensive and seamless care for pulmonary arterial hypertension (PAH) patients as they enjoy the convenience of seeing three specialists in a single clinic session. It also allows the multidisciplinary team to discuss and manage complex PAH cases in the same setting.

OUR PULMONARY HYPERTENSION TEAM

National Heart Centre Singapore

Adj Asst Prof Tan Ju Le	Senior Consultant and Director, Adult Congenital Heart Disease
Adj Assoc Prof Lim Soo Teik	Deputy Medical Director, Senior Consultant and Director, Cardiac Catheterisation Laboratory
Adj Asst Prof Kenneth Guo	Consultant

Singapore General Hospital

Dr Andrea Low	Head and Senior Consultant, Department of Rheumatology & Immunology
Dr Phua Ghee Chee	Senior Consultant
Dr Sewa Duu Wen	Consultant

For the full list of NHCS services and specialists, please visit ***www.nhcs.com.sg.***

Aftercare

Patients living with PAH may not be able to keep up with the active lifestyle they are used to. A task that would normally take an hour may take several days or more. Patients are advised to prioritise their activities and set a realistic goal.

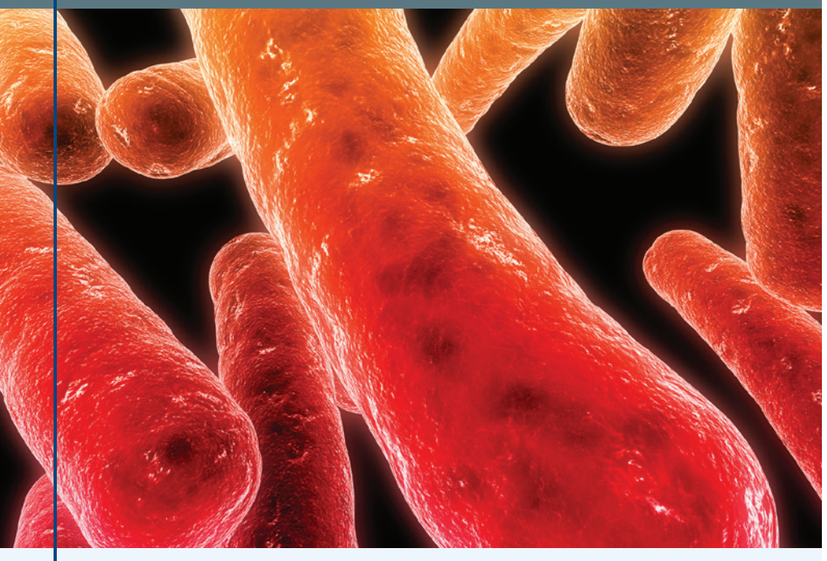
Over-the-counter drugs should be taken with extra care. Some drugs may interact with blood thinners such as warfarin, whereas sedative drugs can worsen hypoxia in patients with PAH. Patients are advised to consult their doctor for advice first.

RESEARCH HIGHLIGHT

Nat Commun. 2015 May 26;6:7200. doi: 10.1038/ncomms8200.

Translational regulation shapes the molecular landscape of complex disease phenotypes.

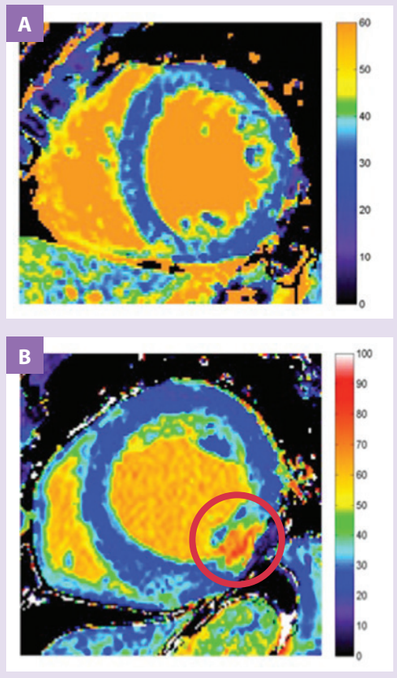
Schafer S, Adami E, Heinig M, Rodrigues KE, Kreuchwig F, Silhavy J, van Heesch S, Simaite D, Rajewsky N, Cuppen E, Pravenec M, Vingron M,Cook SA, Hubner N.



ABSTRACT

The extent of translational control of gene expression in mammalian tissues remains largely unknown. Here we perform genome-wide RNA sequencing and ribosome profiling in heart and liver tissues to investigate strain-specific translational regulation in the spontaneously hypertensive rat (SHR/Ola). For the most part, transcriptional variation is equally apparent at the translational level and there is limited evidence of translational buffering. Remarkably, we observe hundreds of strain-specific differences in translation, almost doubling the number of differentially expressed genes. The integration of genetic, transcriptional and translational data sets reveals distinct signatures in 3′UTR variation, RNA-binding protein motifs and miRNA expression associated with translational regulation of gene expression. We show that a large number of genes associated with heart and liver traits in human genome-wide association studies are primarily translationally regulated. Capturing interindividual differences in the translated genome will lead to new insights into the genes and regulatory pathways underlying disease phenotypes.

Asst Prof Calvin Chin (right), Consultant, Department of Cardiology, NHCS with his research mentor at the University of Edinburgh, Prof David Newby.



T1 maps of the left ventricular myocardium of a normal patient (A) and a patient who suffered a recent heart attack (B). The circled area indicates the region of the heart muscle tissue that died during the heart attack due to lack of oxygen.

PATIENCE, PRECISION AND PERSEVERANCE

A CARDIOLOGIST'S JOURNEY TO BECOMING A CLINICIAN SCIENTIST

Asst Prof Calvin Chin, a Consultant with the Department of Cardiology at the National Heart Centre Singapore recently completed his three-year research fellowship at the University of Edinburgh in April 2015. MURMURS speaks to the budding clinician scientist and running enthusiast on his training stint at one of the world's oldest universities.

What was your training like?

I did my PhD at the University of Edinburgh where I worked on my research thesis examining the role of cardiovascular magnetic resonance and circulating biochemical markers in patients with aortic stenosis, identifying those at high risk who may benefit from early valve replacement. I was under the mentorship of Prof David Newby, the Director of the Edinburgh Clinical Research Facility, University of Edinburgh. Prof Newby has been involved in numerous clinical trials including the pivotal SATLIRE trial that investigated the effects of lipid-lowering statins on aortic stenosis progression.

Research takes a great deal of patience and perseverance, and being meticulous is essential in becoming good at it. In my first year of research, I spent most of my weekends optimising the analysis of myocardial T1 maps – a novel cardiovascular magnetic resonance imaging (MRI) technique of measuring myocardial fibrosis. It was not until 15 months later that the first paper related to my research was published.

My typical work day starts at 7am and ends in the early evening. During the day, I will be responsible for recruiting all patients for the study, drawing and processing their blood samples, performing the echocardiography scans, supervising the cardiovascular magnetic resonance imaging (MRI) scans and analysis, and data entry. Most evenings were spent analysing the data and writing manuscripts. Throughout my three years at the University, I also maintained a clinical echocardiography session to keep my clinical skills sharp and I subsequently obtained my echocardiography accreditation with the British Society of Echocardiography. When I have time, I enjoy going for runs and exploring Edinburgh's historic city.

Asst Prof Calvin Chin took this photo of a performing bagpiper while soaking in Edinburgh's rich cultural atmosphere on his day off.

What were your most memorable moments in Edinburgh?

I won two young investigator awards this year, one of them being the prestigious American College of Cardiology Young Investigator Award. It was a great experience competing on an international platform representing the National Heart Centre Singapore and the University of Edinburgh, and an even greater satisfaction that the importance and clinical relevance of my research was being recognised. This makes all the hard work worthwhile and it was definitely a good conclusion to my PhD.

What would you be bringing to NHCS from your stint?

I will be extending my research to a subgroup of high-risk patients with aortic stenosis and poor heart function. In addition, we will also be examining the role of cardiovascular MRI in patients with hypertensive heart disease. We will be using the optimised and improved myocardial T1 mapping sequence in our research studies with the specific aim of translating this technique for future clinical applications. I have benefitted tremendously in the past three years through learning from my peers and interacting with other scientists and clinicians. I believe these experiences and training will be instrumental in my future career as a clinician scientist.

WHAT HEART PATIENTS CAN EXPECT FROM MEDISHIELD LIFE

COME 1 NOVEMBER 2015, MEDISHIELD LIFE WILL REPLACE MEDISHIELD.

With it, patients pay less via co-insurance and will be able to claim more from MediShield Life. Claim limits for a normal ward stay, for example, will go up from $400 to $700 per day in the new plan. Co-insurance payment for all outpatient treatments will be 10 per cent, a drop from 20 per cent. While the current MediShield has a lifetime claim limit of $300,000 and does not cover Singapore residents beyond the age of 92, MediShield Life has no limit over the lifetime, and no maximum age for coverage.

Here is a sample bill comparing the savings with MediShield versus MediShield Life for a 60-year-old male patient who is hospitalised for 10 days in a B2 class ward after suffering a heart attack.

	With MediShield	With MediShield Life
Bill after government subsidy	$8,100	
Deductible	$2,000 (for B2 class ward)	
Co-insurance	$605	$455
Amount above claim limit	$2,050	$0
Total payable by patient (using Medisave/cash)	**$4,655 (57%)**	**$2,455 (30%)**
Payable by MediShield/ MediShield Life	$3,445 (43%)	$5,645 (70%)

For more information on MediShield Life, please visit www.moh.gov.sg/content/moh_web/medishield-life.html.

APPOINTMENTS

PROF STUART COOK
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MR CHONG PANG BOON
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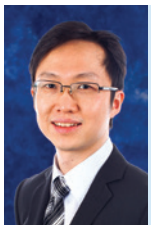
DR ANDERS SAHLÉN
Senior Consultant, Department of Cardiology, NHCS
Subspecialty interest: Echocardiography



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We value your feedback. For comments or queries on Murmurs, please email us at ***nhcs@nhcs.com.sg****.*

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