

# PULSE

ISSUE 36  
FEBRUARY 2021  
WWW.NUHCS.COM.SG

COVER STORY

## *A New Institutional Peak Of Excellence*

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Pulse is a biannual publication by the National University Heart Centre, Singapore (NUHCS)

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# DIRECTOR'S MESSAGE



Dear readers,

Welcoming the arrival of 2021 with unabated breath after a tumultuous year, there is much to reflect on, in our collective memories and experiences.

In the past year of chaotic upheavals, frontline health-care workers bore the full brunt of the coronavirus pandemic. Yet, amidst the health crisis, we managed to maintain our standard of patient care. We even achieved some milestones such as establishing the minimally invasive cardiothoracic surgery (MICTS) as a peak-of-excellence programme, and expanding the cardiogenic shock life-saving programme to benefit more patients since its inception in February 2020.

With the hope that we are close to winning the battle against the coronavirus and moving ahead from the pandemic this year, the National University Heart Centre, Singapore (NUHCS) continues to progress towards actualising the National University Health System (NUHS) Group's clinical plan model of 'One-Service, Multiple-Sites'.

We have mapped out and are embarking on our five-year plan focused on transforming clinical models. As these models gain increased granularity, our plan will include a beyond-hospital-to-community strategy, integrating innovative health technology and modernised tertiary care, increasing patients' access to specialist care through nurse and allied health-led care with specialised clinics, established through a collaborative network within and beyond our cluster.

Our Department of Cardiac, Thoracic and Vascular Surgery (CTVS) will be rolling out its enhanced recovery after surgery model to improve patient experience and outcomes including shortened hospitalisation stays.

At Alexandra Hospital (AH), we are building specialist vascular services that include diagnostic and interventional care; as well as specialist cardiology services such as geriatric cardiology, cardiology sleep medicine and women's heart health. Post-operative inpatient rehabilitative care at AH will be augmented to serve recovering patients before they discharge for home.

What we have witnessed in 2020 was a healthcare system that was squeezed, stretched, expanded and evolved as it underwent stress testing through the pandemic. NUHCS has risen to the challenge and emerged stronger through the darkest of times.

In this new year, knowing now what we are capable of, we shall be resolute in our pursuit of medical excellence and advance further to be ever ready for the next challenge that awaits us.

*Tan Huay Cheem*

**Prof. Tan Huay Cheem**  
Director and Senior Consultant,  
NUHCS





# A NEW INSTITUTIONAL PEAK OF EXCELLENCE

## *Minimally invasive and hybrid cardiothoracic surgery programme*

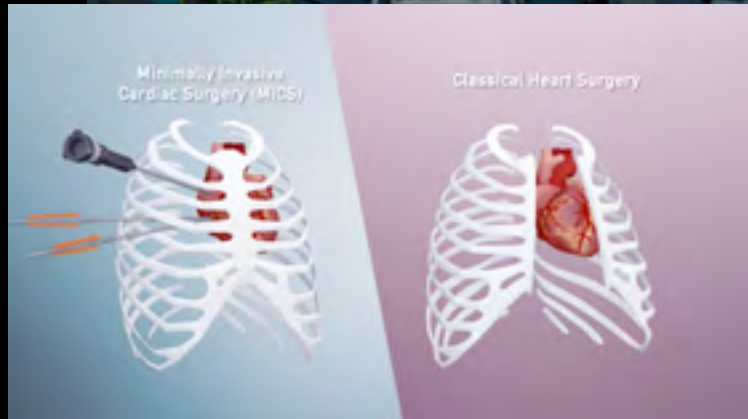
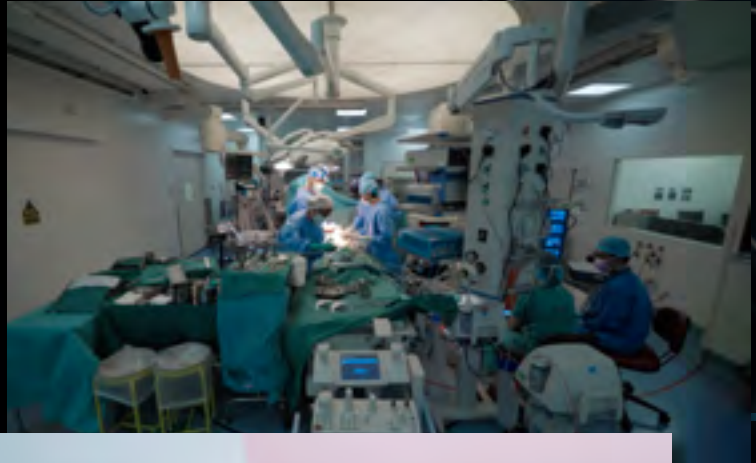
The National University Heart Centre, Singapore (NUHCS) has reached a new institutional peak of excellence with its minimally invasive and hybrid cardiothoracic surgery (MICTS) programme.

The conventional approach to reach the heart and lungs is via a sternotomy where an incision is made to break the

breast bone and open the chest cavity. Plainly, this technique is not without risks and can cause major trauma to the body, requiring a long time for the body to recover and heal post-surgery. In weaker or older patients, “open-heart” surgery may not be the most ideal as they may be unable to tolerate the procedure.

“**Less invasive heart surgery is a plethoric platform that opens new pathways for cooperation within the multidisciplinary team, offering customisable care and attracting more job opportunities as well as patient volumes for a type of surgery that is right for the patient, if the patient qualifies for it.**

A/Prof. Theodoros Kofidis,  
Head and Senior Consultant,  
Department of CTVS, NUHCS



Advanced technology applied in surgery such as laparoscopy<sup>1</sup>, interventional radiology<sup>2</sup> and robotics have paved the way for minimally invasive surgeries – smaller incisions with higher precision and accuracy, achieving better outcomes for patients.

*Minimally invasive surgeries*, otherwise known as keyhole surgeries, have boasted many advantages compared to conventional “open-heart” surgeries that require larger incisions. Whilst large scale population studies are currently not available, numerous case studies worldwide have documented the benefits of keyhole surgeries.

From being viewed as “innovative procedures”, keyhole surgeries are now progressively becoming the gold standard in surgical procedures as patients seek the best possible long-term results with lowest surgical trauma and re-intervention rates. With smaller incisions, patients lose less blood, lowering their risk of infection or arrhythmia and enjoy a better cosmetic (smaller scar) result.

A/Prof. Theodoros Kofidis, Head and Senior Consultant, Department of Cardiac, Thoracic and Vascular Surgery (CTVS), NUHCS has been working closely with a team to review, refine and adapt the best practices of keyhole surgeries from

around the world to establish the MICTS programme here for patients in Singapore.

The orchestration from A/Prof. Kofidis and the efforts put in by his team eventually led to the recent recognition of the MICTS programme as an institutional Peak of Excellence for the advances made in the clinical, educational and research areas.

This recognition was by no means an overnight achievement. It took more than 10 years of the team’s dedication, requiring a transformation in the surgical process which posed a steep learning curve for the team to master the technologies and techniques involved.





Figure 1: NUHCS MICTS Peak of Excellence team



Roles and functions of various medical professionals need to be adapted to ensure the benefits of the keyhole surgical programme are maximised. The medical team, allied health professionals, researchers as well as administrators worked tirelessly hand in hand with patients throughout their journey to evaluate and detail the process – refining the techniques, reducing inefficiencies and perfecting the entire procedure.

Leadership from the National University Health Systems (NUHS) and its hospitals were also critical to ensure that the overall patient experience improved and was not compromised throughout the entire clinical pathway including the perioperative and the rehabilitation process.

To date, over 500 patients in Singapore and from the region have gone through the MICTS programme at NUHCS. Patients have reported comparable or better outcomes and their experiences have been well documented in research studies published in numerous high impact peer-reviewed journals such as *The Annals of Thoracic Surgery* and *European Journal of Cardio-Thoracic Surgery*.

Conventional open-heart surgeries typically takes six to eight weeks for recovery whilst the keyhole approach allowed patients to recover in a shorter time. Patients report being able to return to their regular daily activities sooner, including physical exercise, usual work



Peak of Excellence is an institutional award conferred on new and/or niche clinical services that are recognised for the potential to be developed into peaks of excellence. Such clinical services will need to meet the following criteria.

### Criteria for a programme to reach “Peak of Excellence” status

#### Direct Peak:

- Defined clinical intervention
- Has a direct impact on the lives of patients
- Commonly a clinical breakthrough
- Leads clinical field
- Creates large halo effect
- Patient level impact
- Should be financially sustainable at steady state after initial agreed level of grant / cluster support

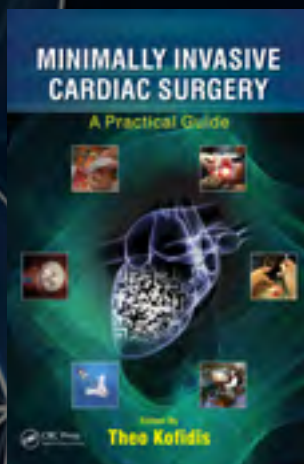
#### Indirect Peak:

- Systems / Models of care / enablers
- Enables other elements to provide care
- Commonly enablers (e.g. AI) and models of care
- Thought / model leader
- Population level impact
- Should be financially sustainable at steady state with agreed level of cluster support



### Procedures that can be done via keyhole approach at NUHCS:

- Mitral valve surgery
- Tricuspid valve surgery
- Aortic valve surgery
- Combined surgeries
- CABG/TECAB/MIDCABG
- ASD closure and treatments of arrhythmias
- All types of transcatheter procedures
- Lung cancer / tumours
- Various thorax procedures



and lifestyle routines. One patient even started training for a 21km marathon four months after his surgery!

Worldwide, keyhole surgeries have rapidly evolved to become the preferred approach for procedures such as mitral valve surgeries and transcatheter procedures. In the last decade at NUHCS, much progress has been made with key improvements to patients' experience and quality of life.

A/Prof. Kofidis and his team have captured their insights in a new book, "*Minimally Invasive Cardiac Surgery: A Practical Guide*", to be published later this year. The book aims to advance patient care and extend the benefits of this technique to more patients in the region. It has been specially designed with interactive multimedia through QR codes to enhance readers' experiences and better demonstrate key concepts expounded in the text.

With links to leading research institutes, the NUHCS MICTS programme has a fertile ground for continuous and extensive study where further developments are being made. In fact, the technique has been proliferated to include more heart and lung procedures and the technique has been refined for various conditions seen in Asian patients.

NUHCS's team has also gone on to train other surgical teams, sharing their learnings and techniques with other medical professionals in Singapore and around the region to accelerate their learning curve and advance the standard of patient care in the region. This includes lending resources and helping other cardiovascular centres set up similar surgical programmes.

At this juncture, the minimally invasive procedure is currently still limited to a certain patient profile. However, as a newly inaugurated Peak of Excellence centre, CTVS NUHCS is confident and hopeful in further developing and establishing the programme as a standard of care across a wide range of possible surgical procedures.

<sup>1</sup>**laparoscopy** – A type of surgical procedure that allows a surgeon to access the inside of the abdomen and pelvis without having to make large incisions in the skin.

<sup>2</sup>**interventional radiology** – A medical subspecialty that involves a range of imaging procedures to obtain images inside the body

#### ARTICLE BY

**A/Prof. Theodoros Kofidis**  
Head and Senior  
Consultant, Department  
of CTVS, NUHCS



A/Prof. Kofidis has been recognised for his innovative surgical discoveries focused on less traumatic heart surgery. His passion in this area led to his founding of the Initiative for Research & Innovation in Surgery (IRIS). He continues to present his work at numerous international conferences as well as lead training workshops for medical teams around the world. He actively contributes to the industry through his multiple concurrent appointments held globally. He remains active in research with many published works, as well as patents, and sits on the editorial review board for a number of scientific journals.



# RISK STRATIFICATION OF CHEST PAIN PATIENTS

**Asia's first Rapid Access Chest Pain Clinic (RACPC) at Ng Teng Fong General Hospital (NTFGH) wins excellence award**

An increasing number of patients experiencing chest pains are going to the emergency department (ED) where waiting times can be long and testing expensive, especially when the patient is admitted.

Patients who are seen at the cardiology specialist outpatient clinic (SOC) often wait several weeks for their first appointment and may return for several hospital visits before a definitive diagnosis can be formed.

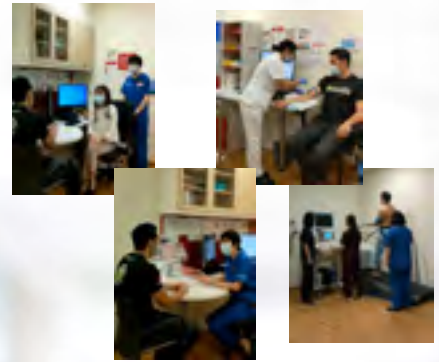
To address the current inefficiencies, a pilot nurse-led, cardiologist-supervised RACPC was set up to improve the diagnostic pathway for patients.

Under this pilot model, patients seen at the primary care clinics with ongoing chest pain or electrocardiogram (ECG)<sup>1</sup> changes suggestive of acute coronary syndromes<sup>2</sup> are immediately sent to the ED. Other patients would be referred to the RACPC for evaluation within 24 hours.

At the RACPC, a specialist chest pain nurse reviews patients' risk profiles, performs blood tests and treadmill ECG<sup>3</sup> before they are reviewed by a consultant cardiologist. The entire process would take less than three hours with patients receiving a complete diagnosis and treatment plan by the end of their visit.

The pilot registered a 98 percent decrease in waiting time for evaluation by a cardiologist. On average, the patient only requires 1.5 hospital visits compared to 3 from before. Consequently, healthcare expenditure fell by 20.7 percent, with inpatient bed days due to chest pains decreasing by 24.7 percent.

Selected from a total of 200 entries from 89 hospitals across 16 countries, this programme was recognised at the Asian Hospital Management Awards 2020, with an Excellence Award in the Patient Experience Improvement Category.



With these results, the RACPC model will be rolled out to more polyclinics and primary care networks this year to benefit more patients.

<sup>1</sup>**ECG** – A test measuring the electrical activity of the heart.

<sup>2</sup>**acute coronary syndromes** – Describes the range of various conditions associated with sudden, reduced blood flow to the heart, often associated with plaque buildup inside arteries causing abrupt limitations of blood flow, consequently leading to a heart attack or stroke.

<sup>3</sup>**treadmill ECG** – Simple test to measure the heart's response to physical stress by having patient walk on a treadmill at increasing speed and difficulty.

#### ARTICLE BY

**Asst. Prof. Pipin Kojodjojo**  
 Director, Cardiovascular  
 Catheterisation Laboratory  
 and Senior Consultant,  
 Department of  
 Cardiology, National  
 University Heart Centre,  
 Singapore (NUHCS)



Asst. Prof. Kojodjojo concurrently holds the positions of Head of Division, Senior Consultant, Cardiology at NTFGH and Asst. Prof. at Yong Loo Lin School of Medicine, National University of Singapore.

# THE HEART TRUTH MANDARIN SYMPOSIUM 2020



*The biennial National University Heart Centre, Singapore (NUHCS) public symposium goes virtual*

Since 2001, NUHCS organises the biennial Mandarin public symposium, “The HEART Truth”, with the aim to educate the public about preventive heart health, share about the latest development in this field and address the public’s misconceptions about heart health.

Due to the Covid-19 pandemic in 2020, the public symposium could not take place in its usual event format where hundreds of participants would gather to discuss concerns about their heart health and engage with cardiologists from NUHCS in person.

With health issues being a key priority for Singaporeans especially during a health crisis, “The HEART Truth” Mandarin

Symposium moved to a virtual platform for the first time – delivered via live video streaming on YouTube.

More than 500 people watched the live video stream on a Saturday afternoon via their computers, mobile phones, tablets or smart TVs.

Delivering a symposium in this manner, without a live audience, was a different experience. Helping to keep viewers engaged through the 90-minute symposium was local radio DJ Anna from Hao FM 96.3, who moderated the event.

Three speakers from the Department of Cardiology, NUHCS – Asst. Prof. Low Ting Ting, Consultant, Asst. Prof. Yeo Tee Joo, Consultant, and Prof. Tan

Huay Cheem, Director and Senior Consultant, NUHCS delivered bite-sized information about heart health issues. They shared about the key differences in heart attacks between men and women, cardiac rehabilitation treatment for patients during the pandemic, as well as the trends and development of coronary angioplasty.

The symposium was well-received, reaching a good mix of Mandarin speakers in Singapore who participated in the lively Q&A session by posting questions through the live chat functions.





“  
**The overwhelming enthusiasm received for our first public virtual event was unexpected, but with this reception, we will surely look into more virtual public events which may perhaps reach more people...**

**Prof. Tan Huay Cheem,**  
 Director and Senior Consultant, NUHCS



ARTICLE BY

**Prof. Tan Huay Cheem**  
 Director and Senior Consultant, NUHCS



Prof. Tan is a Professor of Medicine, Yong Loo Lin School of Medicine, NUS and has a master of Medicine in Internal Medicine. He is an active clinical researcher, visiting professor at several hospitals in China and invited speaker at many international cardiology meetings.

# A CHINA-SINGAPORE COVID-19 WEBINAR

## *A discourse on managing STEMI<sup>1</sup> patients during the coronavirus pandemic*

Following the initial outbreak of the coronavirus in China in December 2019 and the ensuing lockdown of Wuhan city on 23 January 2020, significant changes had to be made for the care of cardiac patients in China. In particular, the treatment of patients with heart attacks.

With concerns about the risk of virus exposure to medical staff and limited screening resources available at that time, coronary angioplasty<sup>2</sup> and stenting could no longer be offered as the first line treatment for reperfusion<sup>3</sup> therapy.

In Singapore, the first Covid-19 patient was diagnosed on 23 January 2020 which was followed by the first reported death on 21 March 2020. Significant changes were made to emergency cardiac services in Singapore. However, Singapore continued to offer coronary angioplasty as the first line of treatment because of the treatment's superior efficacy.

As there were many attendant challenges that confronted interventional cardiologists, National University Heart Centre, Singapore (NUHCS) organised a Mandarin webinar on 11 April 2020 which attracted more than 8,000 viewers.

Chaired by Dr. Lang Li from Guangxi University in Nanning, doctors from major Chinese cities, including Wuhan, Nanjing and Guangzhou were invited to share their experiences in managing STEMI patients during the Covid-19 pandemic.

Prof. Tan Huay Cheem, Director and Senior Consultant, NUHCS, one of the key speakers, expounded on the Centre's response in the pandemic. He emphasised the need to provide sufficient personal protective equipment (PPE),

and to consider the mental and emotional protection for the entire medical team to keep morale up whilst optimising patient care during such trying times.

<sup>1</sup>**STEMI** – A common acronym for ST segment elevation myocardial infarction (STEMI) describing a more severe form of heart attack where the coronary artery is blocked off by a blood clot for a prolonged period of time affecting a large area of the heart which leads to a life-threatening emergency.

<sup>2</sup>**angioplasty** – Procedure which restores blood flow through arteries.

<sup>3</sup>**reperfusion** – Restoration of blood flow to an organ or tissue, typically after a heart attack, which can be done with surgery and/or drugs.

### ARTICLE BY

**Prof. Tan Huay Cheem**  
Director and Senior  
Consultant, NUHCS



Prof. Tan is a Professor of Medicine, Yong Loo Lin School of Medicine, NUS and has a master of Medicine in Internal Medicine. He is an active clinical researcher, visiting professor at several hospitals in China and invited speaker at many international cardiology meetings.





# HONOURING THE LEGACY OF PROF. CHIA BOON LOCK

*Paying it forward with the Chia Boon Lock Memorial Bursary Award*

***A much respected and courageous man who in his 34-year battle with cancer never once wavered in the face of adversity. A brilliant doctor who devoted his entire life to the single-minded pursuit of excellence in cardiology, a selfless teacher who was willing to share his knowledge with others, and a great mentor who was generous and ever ready with his advice...***

Prof. Tan Huay Cheem, *Director and Senior Consultant, NUHCS*



Bursary award recipient Goh Xin Lei (2nd from right)

Three years have passed since well-loved Prof. Chia Boon Lock passed on 27 December 2017. To this day, Prof. Chia's legacy has remained firmly etched in the minds of those whose lives he had touched.

The Chia Boon Lock Memorial Bursary Award was set up in honour of his legacy as an outstanding and devoted educator, mentor and teacher. This award aims to help students pursuing a medical education alleviate their financial burdens. Prof. Chia's peers, colleagues, and ex-students have generously donated more than S\$300,000 to the fund to continue his life's work and passion for imparting medical knowledge.

Ms. Goh Xin Lei, a fifth-year medical student from the Yong Loo

Lin School of Medicine, National University of Singapore (NUS), is the first recipient of the bursary award. With the award, she is at liberty to participate in the school's extra-curricular activities which would contribute to her holistic medical education.

She is also the Playhouse Director for the NUS Medicine Playhouse Annual Drama Competition, a member of an award-winning team in the Medical Grand Challenge which nurtures creativity and cultivates an inquiring and entrepreneurial mind amongst medical students. Outside of her studies, Ms. Goh dabbles in water-colour painting and calligraphy.

In another tribute to the late Prof. Chia, NUS is setting up the Chia Boon Lock Cardiology

Gold Medal and Prize, an annual award for medical students with the best written report on a cardiology research project. The NUS Board of Undergraduate Studies will oversee this award.

At the National University Heart Centre, Singapore (NUHCS), the annual final year medical student weekend teaching course has been named the "Chia Boon Lock Cardiology Review Course", in remembrance of the educator that he was, and to keep his legacy alive.

ARTICLE BY

**Prof. Tan Huay Cheem**  
*Director and Senior Consultant, NUHCS*



Prof. Tan is a Professor of Medicine, Yong Loo Lin School of Medicine, NUS and has a master of Medicine in Internal Medicine. He is an active clinical researcher, visiting professor at several hospitals in China and invited speaker at many international cardiology meetings.



# GOING ON AIR

## *Asian Interventional Cardiovascular Therapeutics (AICT)-AsiaPCR went online*

As with many events, the AICT-AsiaPCR went online in 2020 and was successfully brought to fruition on 13 December 2020.

Initially planned to be held in July 2020, the event had to be cancelled following travel restrictions and government regulations in the wake of the coronavirus outbreak. Nonetheless, PCRBoard Members announced the move of AICT-AsiaPCR to the online space, building on the momentum created following its first PCR e-Course held in June.

The AICT-AsiaPCR, designated as the official scientific meeting of the Asia Pacific Society of Interventional Cardiology (APSIC) aligns with the society's mission of "Transforming Lives Through Advancing Innovation and Global Partnerships".

While it was tricky to deliver the programme entirely online, the programme's directors put together an educational and exciting course to share the latest expertise and knowledge in the field of interventional cardiology with the attendees.

Topics included decision making around dual antiplatelet therapy (DAPT)<sup>1</sup>, the role of

vascular closure devices<sup>2</sup>, indications and techniques for retrograde chronic total occlusion (CTO)<sup>3</sup>, and overcoming challenges of ST-Elevation Myocardial Infarction (STEMI) percutaneous coronary interventions (PCI)<sup>4</sup>.

In a six-hour non-stop meeting, the event attracted more than 2,000 attendees, predominantly medical doctors from all over the world.

<sup>1</sup>DAPT – A treatment therapy where the patient is given two types of antiplatelet agents to prevent platelets in the blood from clotting which can lead to a heart attack or clotting in the coronary stent.

<sup>2</sup>vascular closure device – A device usually made from collagen, metallic clip or suture designed to provide immediate sealing of the small puncture made in an artery after an angiogram.

<sup>3</sup>retrograde chronic total occlusion (CTO) – An innovative approach to treat CTO (a complete or nearly complete blockage of one or more coronary arteries mainly cause by plaque buildup)

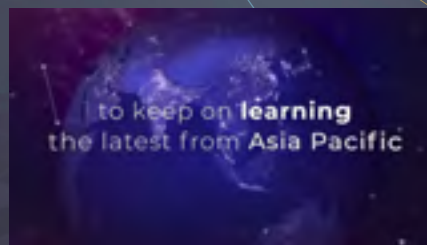
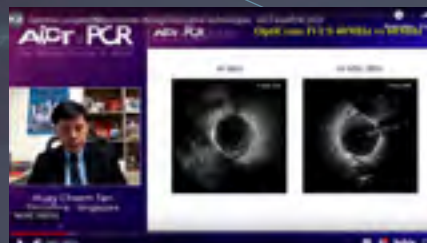
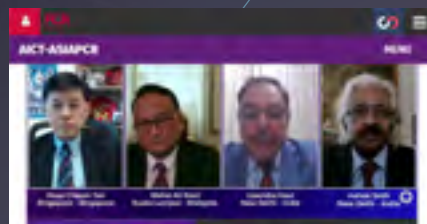
<sup>4</sup>STEMI PCI – A non-surgical procedure to treat the narrowing of the coronary arteries often done through balloon angioplasty to treat a more severe form of heart attack where the coronary artery is blocked off by a blood clot for a prolonged period of time affecting a large area of the heart.

### ARTICLE BY

**Prof. Tan Huay Cheem**  
Director and Senior  
Consultant, National  
University Heart Centre  
Singapore



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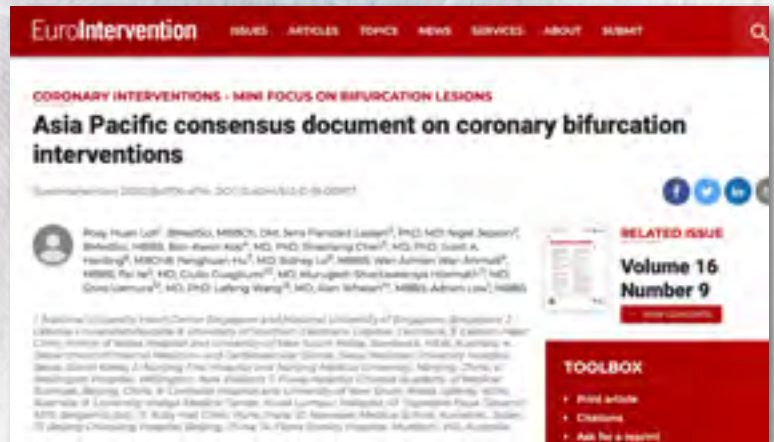


# THE INAUGURAL ASIA PACIFIC CONSENSUS DOCUMENT ON CORONARY BIFURCATION INTERVENTIONS PUBLISHED

*A collaborative effort by 22 experts across 11 countries in Asia Pacific*

“**Through such collaborative effort, challenges could be identified; skills, knowledge and techniques could be shared; collaboration in research could be fostered; resources and data could be appraised and pooled; and partnership could be formed within APAC and beyond.**

*A/Prof. Adrian Low, Senior Consultant, Department of Cardiology, NUHCS*



Coronary bifurcation intervention<sup>1</sup> is common but complex. In recent years, progress has been made in this field with considerable contribution from Asia Pacific (APAC). However, the standard of practice varies across the region due to differences in culture, socio-economic factors and the healthcare set-up. The practice may also differ in other parts of the world.

A/Prof. Adrian Low, Senior Consultant, Department of Cardiology, National University Heart Centre, Singapore (NUHCS) chaired a two-day forum in Singapore where 22 regional experts across 11 countries in APAC convened to discuss and

weigh in on this evolving domain of coronary intervention.

The conclusions drawn were captured in the inaugural APAC consensus document recently published in the *EuroIntervention Journal*.

This consensus document aims to address the differences in practice across the region, as well as between APAC and Europe or the United States of America. It offers insights and techniques originating from the region to cardiologists in other parts of the world.

<sup>1</sup>Coronary bifurcation intervention – the treatment of coronary bifurcation lesions is very dynamic with an ongoing evolution in clinical approaches and techniques and the management of more complex cases continuing to evolve

#### ARTICLE BY

**Dr. Loh Poay Huan**  
Senior Consultant,  
Department of  
Cardiology, NUHCS



Dr. Loh worked as a consultant interventional cardiologist in the UK for two years before joining NUHCS in 2014. He started his career as a researcher in the field of heart failure and refractory angina, before joining the British National Training Program in Cardiology in 2006 and has since continued with his specialist training in interventional cardiology. He continues to be active in research with a number of published research across various cardiology journals.

**A/Prof. Adrian Low**  
Senior Consultant,  
Department of  
Cardiology, NUHCS



A/Prof. Adrian Low is also the current Programme Director of Acute Coronary Syndrome Programme in NUHCS. As a Senior Consultant, his focus remains clinical where he has expanded the radial vascular access program at NUHCS and advocates for radial and small access vascular interventions. He is a keen researcher and is also an advocate of functional evaluation of coronary artery disease and the use of pressure wire guided interventions to reduce unnecessary procedures.



# RAISING COMPETENCY LEVELS WITH MEDICAL SIMULATION TRAINING

*New high fidelity endovascular simulators mimic realistic procedural environment*

Equipped with Somnotec's Mentice VIST® G5 endovascular simulators, the National University Heart Centre, Singapore (NUHCS) now boasts a high fidelity<sup>1</sup> system that is able to simulate a wide range of cardiovascular surgeries. This enables hands-on procedural training for clinicians and surgical teams to raise their level of clinical proficiency, including the rehearsal of pre-operative procedures – all without jeopardising patients' safety.



The system offers a suite of modules with various scenarios in peripheral and aortic interventions<sup>2</sup> (including aortic valve) as well as coronary procedures which allow medical professionals to play out a wide variety of scenarios and error-prone situations, subsequently receiving immediate objective feedback for reflection on their performance in a controlled setting.

Simulation realism allows individuals or teams to train together, working through a range of scenarios as experiential training based on real-life situations. Additionally, this system provides a structured syllabus for each module which helps to score and certify teams prior to actual clinical situations.

<sup>1</sup>**high fidelity** – The reproduction of an effect (sound or image) that is very close to the original.

<sup>2</sup>**peripheral and aortic interventions** – Procedures to treat peripheral artery disease which is the narrowing of arteries that affects blood flow to the legs, stomach, arms and head.

<sup>3</sup>**Balloon valvuloplasty** – A procedure to repair a heart valve that has a narrowed opening.

<sup>4</sup>**thoracic aortic aneurysms** – The weakened areas in the aorta which can cause bulging like a balloon (aneurysm) due to the blood pushing against the vessel wall.

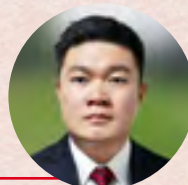
<sup>5</sup>**dissections** – Tears in the wall of blood vessel wall that can cause life-threatening bleeding or sudden death

<sup>6</sup>**angiography** – An imaging test that uses X-ray to view blood or lymph vessels

<sup>7</sup>**PCI** – A non-surgical procedure to treat the narrowing of the coronary arteries, often done through balloon angioplasty.

## ARTICLE BY

**Dr. Chang Guohao**  
Consultant, Department of Cardiac Thoracic and Vascular Surgery (CTVS), NUHCS



Dr. Chang is an accredited specialist in cardiothoracic surgery by Singapore's Ministry of Health and was awarded the College of Surgeons Gold Medal in Cardiothoracic Surgery. He is currently a Consultant in the Department of CTVS at NUHCS with interests in all aspects of adult cardiac surgery including extracorporeal life support.

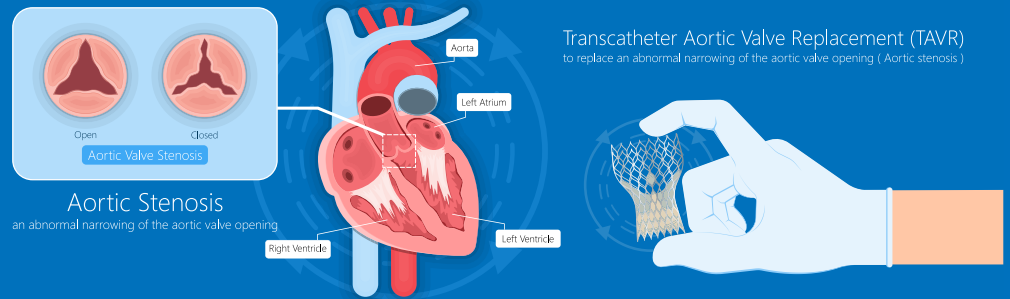
**A/Prof. Andrew Mark Tze Liang Choong**  
Consultant, Department of CTVS, NUHCS



A/Prof. Choong is a consultant, vascular, endovascular and aortic surgeon at NUHCS. He is a well-published and active researcher, having been invited to deliver keynote lectures at numerous international conferences. He also lectures in his concurrent positions as a core faculty member in the National University Health System (NUHS) Research Residency Programme as well as an assistant professor at Yong Loo Lin School of Medicine, National University of Singapore (NUS). Prior to NUHCS, he was a consultant in vascular and endovascular surgery at King's College Hospital in the United Kingdom.



## TRANSCATHETER AORTIC VALVE IMPLANTATION MODULE



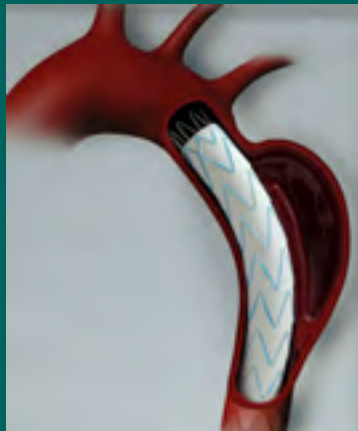
This module provides pre-procedural practice to execute a seamless and safe transcatheter aortic valve implantation (TAVI) workflow for the treatment of aortic stenosis which occurs

when the heart's aortic valve narrows, reducing blood flow onward to the rest of the body.

It provides individual and team-based training in:

- Acquiring implant annular plane
- Crossing the stenotic aortic valve and wire placement
- Balloon valvuloplasty<sup>3</sup>
- Valve implant

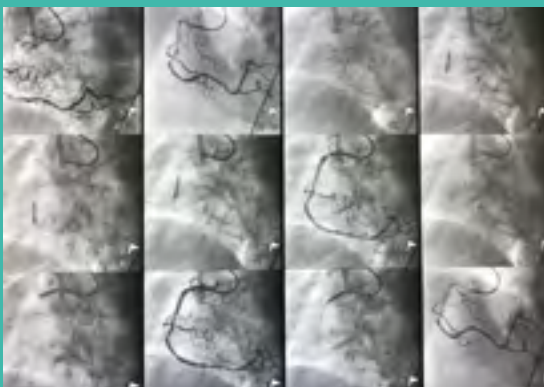
## THORACIC ENDOVASCULAR AORTIC REPAIR MODULE



This module provides pre-procedural practice to execute a seamless and safe thoracic endovascular aortic repair (TEVAR) workflow for the treatment of thoracic aortic aneurysms<sup>4</sup> and dissections<sup>5</sup>. TEVAR is a minimally invasive procedure to repair the aorta, the major blood vessel which exits the heart and carries blood to all the organs in the body. The module focuses on the following:

- Wire exchange
- Crossing the aortic arch
- TEVAR stent deployment

## CORONARY ESSENTIALS TRAINING MODULE



This module covers the fundamentals in diagnostic angiography<sup>6</sup> and percutaneous coronary intervention (PCI)<sup>7</sup>. The software also allows proctors to remotely introduce in real-time complications and manipulate scenarios using a tablet. Using lesion scoring and navigation training exercises, it focuses on the following:

- Identifying lesions
- Comprehend anatomical structuring
- Selection of appropriate devices depending on the approach and anatomy

# BEST CARE EVERY TIME

## *Developing an integrated care pathway to improve coronary artery bypass surgery (CABG) outcomes*

ProvenCare® is an intensive, evidence-based treatment programme focused on ensuring the best care is delivered to patients. At the core of the programme, the process applies evidence-based protocols aimed at reducing mortality rates, improving outcomes, and reducing costly hospital re-admissions by offering a “warranty” for patients in this programme.

By eliminating unwarranted variation and applying scientific best practices to CABG patients, Geisinger, the hospital group which pioneered the model, has been able to reduce hospital re-admissions, complications, length of stay, unnecessary resource utilisation and costs.

With the recommendation from Singapore’s Ministry of Health, the National University Heart Centre, Singapore (NUHCS) has reviewed the model and received funding from the Health Services Development Programme to develop and implement a new integrated care pathway to improve CABG outcomes, inspired by the ProvenCare® model.

From a historical perspective, previous care pathways

in adult cardiac surgery have not been followed up consistently. Currently, the Value-Driven Outcomes analysis of some care processes showed a variance of 30 to 96 percent for follow-up care processes such as early post-operative antiplatelet<sup>1</sup> therapy, use of beta blockers<sup>2</sup>, secondary prevention with statins<sup>3</sup>, and early post-operative mobilisation.

One of the key features of the ProvenCare® model is its ability to provide quality and consistency for specific medical procedures and services, embedded into the electronic health record system to provide decision support for the care team, ensuring that care is given in the most efficient and consistent manner possible.

NUHCS recently implemented this multifaceted programme in hopes of replicating similar results. The team at NUHCS has begun to establish a consensus on key best practices that should be consistently delivered to patients to ensure reliable delivery of such care. Eventually, the goal is to not only reduce the mortality rate of patients but also, post-operation complications for a better quality of life.

<sup>1</sup>**antiplatelet** – Medication that stop platelets in the blood from sticking together and forming a clot.

<sup>2</sup>**beta blockers** – A class of drugs that reduce blood pressure by blocking the effects of hormones, epinephrine and adrenaline.

<sup>3</sup>**statins** – A class of drugs aimed at reducing illness and mortality in those who are at high risk of cardiovascular disease.

***Much credit goes to Ms. Choo Mei Ling from the Operations and Administrations Department for her persistence and patience over the nine years from our first submission to the eventual approval of funding.***

**Asst. Prof. Kristine Teoh Leok Kheng,**  
Senior Consultant, Department of CTVS,  
NUHCS

#### ARTICLE BY

**Asst. Prof. Kristine Teoh Leok Kheng**  
Senior Consultant,  
Department of Cardiac,  
Thoracic and Vascular  
Surgery (CTVS), NUHCS



Having worked with mostly elderly patients for over 10 years at a number of cardiothoracic units in the United Kingdom, Asst. Prof. Teoh has a special interest in improving healthcare provision, quality outcome measures, and innovative transcatheter therapies that avoid the need for major open surgery. In Singapore, she pursues her interests at NUHCS and remains passionate about teaching and training through her role as an assistant professor at the Department of Surgery, Yong Loo Lin School of Medicine, National University of Singapore (NUS).





*One of the greatest benefits is the opportunity for staff across the three centres to meet and strengthen our working relationship. This synergy is especially meaningful in time-sensitive operations concerning people's lives. I'm grateful to all those who have contributed in making this a successful event.*

*Asst. Prof. Chai Ping, Head & Senior Consultant, Department of Cardiology, NUHCS*



# RAPID IMPROVEMENT EVENT

## *Transfer of complex cardiac patients between hospitals*

Frequently, critically ill cardiac patients need to be transferred urgently from Ng Teng Fong General Hospital (NTFGH) or Alexandra Hospital (AH) to the catheterisation labs (cathlabs)<sup>1</sup> at National University Hospital (NUH) for diagnostic procedures and emergency interventions such as inotropic support<sup>2</sup>, mechanical ventilation and intra-aortic balloon counterpulsation (IABP)<sup>3</sup>.

Inter-hospital transfers of these high-risk patients is a complex exercise, fraught with potential complications and rapid changes in the patients' condition. This places great demands on the healthcare personnel carrying out the transfer where speed is critical and leaves no room for error.

To streamline the process, personnel from NTFGH, AH and NUH came together in a rapid

improvement event (RIE) to deliberate over the issues.

An intensive workshop conducted over a week brought key personnel from the three centres together to map out clear pathways for patients with the following key benchmark indicators:

- Optimise patient safety
- Achieve best time possible in the transfer of critical patients to NUH's cathlabs
- Optimise communication updates on patients' condition throughout transfer
- Detecting, monitoring and managing adverse events
- Emergency response should patients' condition deteriorates

This RIE provided a platform for members to better understand and appreciate the challenges faced by each centre, and work on how to overcome these gaps together.

From this RIE, a new workflow was established that will be implemented in phases over a few months to ensure a seamless transition, and allow personnel to be familiarised with the new process.

<sup>1</sup>**cathlabs** – A special hospital room where a specially trained cardiac team performs minimally invasive tests and procedures with the patient usually conscious.

<sup>2</sup>**inotropic support** – Therapy that changes the force of the heart's contractions to stabilise blood circulation and to optimise oxygen supply.

<sup>3</sup>**IABP** – The most common method using a temporary mechanical assist device to support blood flow and oxygen supply for the heart.

### ARTICLE BY

**Asst. Prof. Chai Ping**  
Head & Senior Consultant,  
Department of Cardiology,  
National University Heart  
Centre, Singapore (NUHCS)



Asst. Prof. Chai Ping was accredited as specialist in cardiology in 2002. Subsequently, he did his fellowship in Cardiovascular Magnetic Resonance at the Royal Brompton Hospital in London, the United Kingdom from the period of 2004 to 2005. His specialty interest lies in heart failure and non-invasive cardiovascular imaging. He is heavily involved in medical and nursing education.

# ALL ABOUT BLOOD PRESSURE

ARTICLE BY  
NUHCS Pulse Editorial

- Eat healthy. Reduce salt intake.
- Do not smoke
- Avoid alcohol
- Look after your mental health
- Keep active. Exercise regularly.
- Maintain healthy body mass index (BMI)

**Blood Pressure** is the force of blood pushing against your artery walls as it goes through your body. Your blood pressure changes as you engage in different activities throughout the day. The “normal” range can also vary slightly from person to person depending on their age and physique. However, if your blood pressure is within the low or high range many times in a day, visit a doctor to get a more detailed analysis.

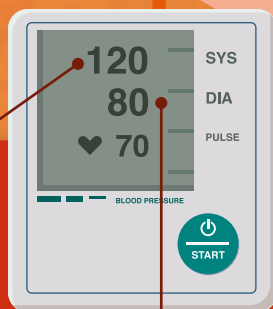
**Healthy BMI Range:**  
18.5 to 22.9  
**BMI = (Weight in kilograms) / (Height in metres)<sup>2</sup>**

## SYSTOLIC PRESSURE

Pressure when your heart contracts / squeezes to push out blood to the rest of your body

## DIASTOLIC PRESSURE

Pressure when your heart relaxes and fills with blood and oxygen



**1 IN 4**

aged 30 to 69 in Singapore have high blood pressure

Systolic Pressure	90	120	140	above 180
	LOW	NORMAL	HIGH	VERY HIGH
Diastolic Pressure	60	80	90	above 120
Condition	Low Blood Pressure a.k.a. Hypotension  Sudden drops in pressure can be life-threatening. In older people, it could mean that blood is not being effectively pumped to all parts of their body and should seek medical advice.	Normal	High Blood Pressure a.k.a. Hypertension  Most people do not have any symptoms	Danger of arteries bursting  Warning: Danger of stroke or heart attack.






# Breakfast FOR THE HEART

## Two breakfast recipes for the time-starved

So much to do and in a rush? These heart healthy recipes will take just 10 minutes to prepare and are perfect to kickstart your day!

 Patients with comorbidities should consult with a dietitian for a customised diet plan.

ARTICLE BY

NUHCS Pulse Editorial



### CLASSIC YOGHURT PARFAIT

Best for freestylers! You can layer it anyway you like. Try switching between soft and crunchy bases, and allowing the parfait to sit overnight for a tastier snack in the morning.

#### Ingredients:

**½ cup Greek yoghurt, dry oats, cereal or nuts and fruits**

1. Slice fruits to fit them in your cup. Strawberries and blueberries are great for heart health so be generous with these.
2. Fill your cup with the ingredients in layers. Alternate layers with yoghurt, fruits and dry cereal or oats.
3. Nuts have been proven to reduce the risk of heart disease. In fact, we recommend a cup (about 40g) of nuts a few times each week for adults.
4. Layer all these awesome ingredients in your favourite cup before starting on your parfait.
5. Refrigerate overnight for added flavor.

### TWO-INGREDIENT PANCAKE

This recipe is a winner especially for those looking for gluten-free or dairy-free options. Cooking these pancakes could be tricky as they cannot hold their shape well, but you can keep your pancakes small to make them easier to cook and flip.

#### Ingredients:

**2 eggs & 1 ripe banana**

1. Mash up the banana and beat it in with the eggs.
2. Heat your pan over medium heat with some olive or vegetable oil.
3. Pour the mixture into the pan and gently fry it. Flip it after a minute to cook the other side.
4. Serve warm.



# SPECIALIST IN TRAINING

## *Completing a fellowship during a pandemic*

**D**r. Lim Yoke Ching, Consultant, Department of Cardiology at National University Heart Centre, Singapore (NUHCS), received the Health Manpower Development Programme (HMDP) award, which gave her the opportunity for further training as a fellow in advanced heart failure at the Royal Papworth Hospital (RPH) in Cambridge, the United Kingdom (UK).

It is one of the largest heart and lung transplant hospitals in the UK, having performed the most number of heart and lung transplants in the country in recent years.

Under the mentorship of five heart failure and transplantation cardiologists, Dr. Lim was exposed to a wide range of patients – from those with chronic heart failure in the outpatient clinics to patients with cardiogenic shock<sup>1</sup> requiring mechanical circulatory support and heart transplantation.

She also had the opportunity to hone her skills in endomyocardial biopsy<sup>2</sup> and right-heart catheterisation<sup>3</sup>. As part of her

training, she also saw patients in the cardiomyopathy<sup>4</sup> clinic, and the cardio-genetics<sup>5</sup> clinic at both the RPH and Addenbrooke's Hospital located in Cambridge.

While her time at RPH was shortened due to the pandemic, Dr. Lim expressed her gratitude for the opportunity to advance her training under the highly regarded fellowship programme.

Aside from the depth and breadth of exposure, the programme allows for close interaction with faculty members as well as a balanced schedule for research and clinical experience, critical in sharpening the skills of a cardiologist.

#### ARTICLE BY

**Dr. Lim Yoke Ching**  
Consultant, Department  
of Cardiology, NUHCS

Dr. Lim joined NUHCS after completing her senior residency training in cardiology at NUHCS in 2017. She has a special interest in heart failure and in women's heart health. She is currently a core faculty member of the NUHCS Cardiology Senior Residence Programme and an assistant professor with the Yong Loo Lin School of Medicine, National University of Singapore (NUS).



<sup>1</sup>**cardiogenic shock** – Condition when the heart suddenly cannot pump enough blood to meet the body's needs. This condition is often fatal if not promptly treated.

<sup>2</sup>**endomyocardial biopsy** – A procedure where small amounts of heart tissue is obtained for further testing such as diagnostic, therapeutic and research purposes.

<sup>3</sup>**right-heart catheterization** – Also known as a pulmonary artery catheterization, this procedure measures the pressures in the heart and lungs.

<sup>4</sup>**cardiomyopathy** – Disease of the heart muscle which makes it harder to pump blood to the rest of the body. There are various causes and different types of cardiomyopathy.

<sup>5</sup>**cardio-genetics** – The inter-discipline area describing the work combining expertise from genetics and cardiology to study the genetic causes of heart disease.

***My time spent at RPH has been productive and insightful at every turn. It has been nothing short of inspirational and I am excited to apply my new knowledge upon returning to NUHCS.***

**Dr. Lim Yoke Ching**, Consultant,  
Department of Cardiology, NUHCS



# IN THE SPOTLIGHT

**Dr. Peter Chang starred as *Body & Soul's* weekly co-host on TV**

*Body & Soul* is a television health talk show aimed at demystifying health issues. Medical professionals are invited as co-hosts on the show to address common health concerns in Singapore.

The Pulse editorial team sat down with Dr. Peter Chang, Consultant, Department of Cardiology, National University Heart Centre, Singapore (NUHCS) who was invited to co-host Season 8 of the show and find out more about his filming experience.

**PULSE:** *What were your initial thoughts when you first got the call for the show?*

**Dr. Chang:** It was supposed to be the year that my two sons, Daniel and Charlie, turned from babies to toddlers. Then came the coronavirus. It put a spotlight on how fragile we are and I realised more people were becoming more aware and interested in their health. When

the call came, I thought it was a great opportunity for people to learn about health matters as they are spending more time at home.

**Lights, camera, action! What was it like filming for a TV show?**

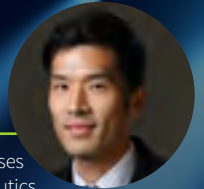
The first time I stepped into the studio, I was immediately taken aback by the number of lights over me. I thought, the idiom “be in the spotlight” should be changed to “be in the spotlights”!

As I settled my anxiety, the nervousness quickly turned into an appreciation for the dynamic rhythm palpable on the set. From the make-up artist and writers, to the cameramen and producers, the flow of everyone seemingly working as one with a razor-sharp focus was similar to that of a musical performance.

Being a TV rookie, I tried to learn as much as I can, and observed

ARTICLE BY

**Dr. Peter Chang**  
Consultant, Department of  
Cardiology, NUHCS



Dr. Chang is passionate about diseases affecting blood vessels and therapeutics for peripheral artery disease. His special interests is in the area of vascular medicine, treatment of critical limb ischemia and prevention of limb amputation. On the research front, he is currently focused on topics related to the recognition of peripheral artery disease and cardiovascular risks.

my celebrity co-host, Vernetta Lopez. She would calmly show me how she hit her marks, find her light, and deliver her lines perfectly each time. On my own, I too tried to picture and emulate Dr. Oz on his own show.



Dr. Mehmet Oz is a cardiac surgeon and an American celebrity, having appeared on numerous TV shows as well as hosting his own talkshow “The Dr. Oz Show” distributed by Sony Pictures Television.

**Was there any particularly memorable event for you?**

It was six days of intense filming. After all that time in the studio, I bonded with everyone and felt extremely honored to be given such an important opportunity this year. I sincerely thank everyone for helping me reach a new stage where I can proudly mark as my achievement for 2020.



# STAYING CONNECTED WITH PATIENTS

## *Meet the first Certified Cardiac Device Specialist (CCDS) nurse in Singapore*

Specialised nurses play a critical role in a patient’s journey. Trained with specific skillsets, specialised nurses are a stable and valuable medical resource, providing the 24-hour presence, helping to optimise patient care management. This is especially pertinent where cardiovascular conditions are often associated with significantly high morbidity and mortality rates, and patients are often seen at the emergency department of hospitals.

With such intense complexities in cardiovascular conditions, most nurses working at the National University Heart Centre, Singapore (NUHCS) undergo further specialised training to play a greater role in patient care management. More importantly, their specialised training helps to ease the pressure for early specialist review which is especially critical when attending to cardiac patients and

helping with the early triage of patients.

One such nurse, Ms. Lai Lee Wah, Senior Staff Nurse (SSN), Arrhythmia Management, NUHCS specialises in the electrophysiology (EP)<sup>1</sup> service since 2015. The EP field has evolved rapidly in recent years with various therapeutic procedures and innovative technologies available to treat a wide range of heart rhythm problems.

On top of her usual nursing duties such as nursing wounds, monitoring for post-procedure complication and educating patients on their condition to keep them informed of their health status, Ms. Lai, as an EP nurse, is responsible for the care management of patients after their EP procedures. This includes the remote monitoring of patients’ heart electrical activity after the insertion of their pacemakers



“**What drew my interest in EP was that I find the latter to be academically and scientifically interesting, especially the interpretation of the different kinds of electrocardiogram (ECG).**”

Ms. Lai Lee Wah, SSN, Arrhythmia Management, NUHCS

and implantable cardioverter defibrillator (ICD)<sup>2</sup>.

She works with the EP cardiac technicians to remotely monitor the electrical activity of the patients’ hearts through their pacemakers, ICD and implantable loop recorders for any potential adverse events. This allow patients to go about their daily lives and greatly reduces the need for frequent follow-ups in the clinic.

Because of the fast evolving technology in this field, Ms Lai





needs to stay up-to-date with the latest developments in the industry, and has also been instrumental in providing in-service training to other nurses in this area.

Recently, she earned her credentials from the International Board of Heart Rhythm Examiners (IBHRE) to become the first CCDS-certified nurse in Singapore.

NUHCS Acting Asst. Director of Nursing, Ms Doreen Chew caught up with Ms. Lai to find out more about her nursing journey.

**Doreen:** Please share with us how your training has helped you in your role.

**Lee Wah:** There has been a number of innovative medical technologies which has helped cardiovascular patients continue to lead good quality lives, even after surgical procedures. This means that the medical team, and us nurses, will be required to stay up-to-date with the latest technology to ensure we are able to operate and manage the devices to improve the health of our patients.

The CCDS is a globally recognised programme, established by the IBHRE, which ensures that certified professionals are familiar with, and have a sound understanding of

the technology, clinical practice, diagnosis, interpretation and management of any heart arrhythmia abnormalities.

With nearly 1,000 cardiac devices implanted in Singaporeans every year, I feel it is critical to ensure we become very familiar with these devices so we can better manage our patients' health, leveraging on the technology. Being skilled in this area also allows me to play a greater role in my patients' care and become a better team support for my colleagues.

**Could you share any memorable experience as a nurse?**

Attaining the CCDS certification was a definitely high point in my career. In 2019, I was also given the honour to present our initiative "Coban versus Elastoplast pressure bandage for Cardiovascular Implantable Electronic Device (CIED) implantation" at the Asia Pacific Heart Rhythm Society (APHRS) Conference.

Looking back on these events, I cannot be more grateful for the leadership, encouragement and support from my colleagues including doctors, device vendors and technicians who have generously shared their knowledge with me, allowing me to advance in my own career.

**Surely it must have been difficult. How did you cope?**

Nursing is a dynamic role which requires constant study and practice. Working in a hospital also keeps me busy, so the main challenge for me was juggling work and studies. I simply could not have achieved all these without the support of my colleagues and supervisors who have been so generous in guiding and supporting me along the way. I believe cardiac devices will become more commonplace so I am very glad to have attained the CCDS certification as I continue to develop and deepen my skills in this area.

<sup>1</sup>EP – The branch of physiology which studies the electrical activity and pathways of biological cells and tissues.

<sup>2</sup>ICD – A small device inserted under your skin in the chest to monitor your heart rhythm and detect abnormal rhythm which could signal a potential heart attack.

ARTICLE BY

**Ms Doreen Chew**  
Acting Asst. Director  
of Nursing, Acute Care  
Advanced Practice  
Nurse, NUHCS



Ms. Chew has over 20 years of clinical practice experience, specialising in acute care. She is the elected Chairperson of the National University Hospital (NUH) Nurse Leaders Council and Advisor for Professional Practice Council. She is also an active member in the Kent Ridge Redevelopment Nursing Workgroup.

# A COG IN THE WHEEL

## *Singapore's role in the International Study of Comparative Health Effectiveness with Medical and Invasive Approaches (ISCHEMIA) trial*

The National University Heart Centre, Singapore (NUHCS) and National University Health System (NUHS) have done well in the landmark ISCHEMIA study, a randomised controlled trial sponsored by the National Heart, Lung, and Blood Institute (NHLBI) from the United States of America (USA), which investigated outcomes associated with routine invasive strategies versus conservative strategies.

In the ISCHEMIA trial, 5,179 patients with moderate or severe ischaemia<sup>1</sup> were randomly assigned to an initial invasive strategy (angiography<sup>2</sup> and revascularisation<sup>3</sup> when feasible) and medical therapy; or to an initial conservative strategy of medical therapy alone and angiography, if medical therapy failed.

The ISCHEMIA trial showed that patients with significant, but stable coronary artery disease were better off with lifestyle changes and medications instead of invasive procedures such as stenting<sup>4</sup> or bypass surgery. However, patients with chest pain symptoms who underwent heart procedures felt better and reported a better quality of life.

Results from the studies have been published in the *New England Journal of Medicine* with further commentaries published across many journals discussing the significance of the studies.

In Singapore, NUHCS / NUHS recruited the highest volume of

subjects for the main ISCHEMIA study and the ISCHEMIA-CKD study and the only center in Singapore to have recruited subjects for the CIAO-ISCHEMIA ancillary study. Globally, Singapore is ranked 11th in the main ISCHEMIA and eighth in the ISCHEMIA-CKD studies respectively.

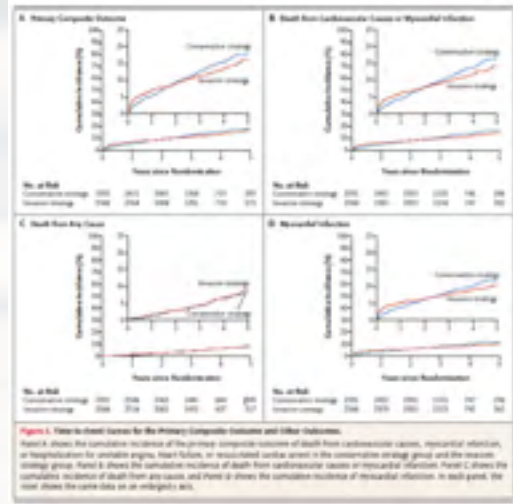
A/Prof Poh Kian Keong, Senior Consultant, Department of Cardiology, NUHCS was the site principal investigator for the main study and the country principal investigator for the ISCHEMIA-CKD study. NUHCS received several awards for its role in the landmark trial, including an acknowledgement for the high quality of data.







NUHCS/NUHS ISCHEMIA Study Team



Reproduced from **Initial Invasive or Conservative Strategy for Stable Coronary Disease**. N Engl J Med 2020 Apr;382(15):1395-1407.

**Contributors from NUHCS include:**

- A/Prof. Theodoros Kofidis, Head and Senior Consultant, Department of Cardiac, Thoracic and Vascular Surgery (CTVS)
- Asst. Prof. Kristine Teoh, Senior Consultant, Department of CTVS
- Asst. Prof. Joshua Loh, Senior Consultant, Department of Cardiology
- Asst. Prof. Edgar Tay, Senior Consultant, Department of Cardiology
- Asst. Prof. Chan Koo Hui, Senior Consultant, Department of Cardiology
- Asst. Prof. Chai Ping, Head & Senior Consultant, Department of Cardiology
- Asst. Prof. Raymond Wong, Senior Consultant, Department of Cardiology
- Asst. Prof. Chan Wan Xian, Senior Consultant, Department of Cardiology

- Ms. Vion Tan, Senior Clinical Research Coordinator, Department of Cardiology
- Ms. Audrey Leong, Clinical Research Coordinator, Department of Cardiology
- Ms. Winnie Sia, Senior Assistant Manager, Department of Operations and Administration

**Contributors from National University Hospital (NUH) include:**

- Asst. Prof. Lynette Teo, Senior Consultant, Department of Diagnostic Imaging
- Dr. Ong Ching Ching, Senior Consultant, Department of Diagnostic Imaging
- Dr. Titus Lau, Senior Consultant, Department of Medicine

<sup>1</sup>**ischaemia** – A reduction in blood flow to the heart due to narrowing of the blood arteries caused by cholesterol deposits

<sup>2</sup>**angiography** – An imaging test that uses X-ray to view blood or lymph vessels

<sup>3</sup>**revascularisation** – The restoration of perfusion to a body part or organ that has suffered from ischaemia

<sup>4</sup>**stenting** – The placement of a stent which is a metal or plastic tube inserted into a vessel to keep the passageway open

ARTICLE BY

**A/Prof. Poh Kian Keong**  
Senior Consultant,  
Department of  
Cardiology, NUHCS



A/Prof. Poh is presently a Senior Consultant and Director of Research at the Department of Cardiology, NUHCS. He is Editor-in-Chief of the Singapore Medical Journal, member of the editorial boards of the Journal of the American Society of Echocardiography and Cardiac Failure Review and reviewer of multiple high-impact factor journals.

**Ms. Vion Tan**  
Senior Clinical  
Research Coordinator,  
Department of  
Cardiology, NUHCS



As a Senior Clinical Research Coordinator, Ms. Tan works closely with the investigators and is responsible for the coordination and administration of clinical trials.

# BEING MORE PRECISE ABOUT HEART FAILURE

*New biomarkers identified can predict heart failure after a heart attack*

**P**roteins are considered a type of biomarker based on their characteristics and can serve as indicators to identify a biological case or situation as well as detecting any presence of biological activities and processes.

Hundreds of proteins have been found to be associated with the development of heart failure after a heart attack, also known as a myocardial infarction (MI).

However, researchers have yet to determine if any of these proteins can be a useful biomarker for diagnostic or predictive accuracy, or to potentially point to novel therapeutic targets for use in heart failure patients.

A/Prof. Mark Chan, Senior Consultant, Department of Cardiology, National University Heart Centre, Singapore (NUHCS), and Prof. A. Mark Richards, Senior Consultant, Department of Cardiology and Deputy Direc-

tor, NUHCS, together with a team of researchers, combined two powerful new technologies, large-scale plasma<sup>1</sup> proteomics<sup>2</sup> and single cell transcriptomics<sup>3</sup>, to help accelerate the process of unearthing proteins in the blood that indicate early-risk heart failure among patients who had heart attacks.

Their study was recently published in the high-impact medical journal, *Circulation*.

Emerging proteomics techniques have proved promising in this area for its high sensitivity and accuracy in identifying and discovering reliable biomarkers using proteins. Investigators from NUHCS collaborated with others from Christchurch, New Zealand to study the blood protein profiles of 654 heart attack patients in both Singapore and New Zealand measuring 1,300 proteins simultaneously in a single drop of blood using large-scale plasma proteomics.

To confirm that the proteins being measured had actually increased because of changes in living cells rather than through a non-specific release from dying heart muscle cells early after the MI, the investigators waited one month after the MI before taking blood samples and performing the assay<sup>4</sup>.

Through this, more than 200 proteins were found to predict the future onset of heart failure up to seven years after the MI.

The investigators then cross-referenced these proteins with their upstream genomic building blocks, called messenger RNA. They studied tens of thousands of messenger RNA sequences from more than 6,000 individual cells harvested from animals and human subjects with heart failure leveraging on advanced single-cell transcriptomics.





The technological advancements in single cell transcriptomics has evolved greatly in the last decade and is the cornerstone from which a number of recent discoveries were made in our understanding of cells and tissues in health and diseases.

In this study, in addition to observing the presence of two well established biomarkers (*N-terminal B-type natriuretic peptide* and *cardiac troponin T*) of heart failure after MI, investigators had identified four new proteins namely *angiopoietin-2*, *thrombospondin 2*, *latent transforming factor- $\beta$  binding protein-4* and *follistatin-like protein-3* that allowed early prediction of heart failure after an MI episode.

Acting on results from this research, A/Prof. Chan and his research team are currently working with biomedical engineers to develop a method, known as “lab-on-chip”, to effectively capture and measure these proteins with high-precision on a user-friendly platform.

In parallel, Prof. Richards has also completed further research on some of these proteins, proving that modifying their effect can accelerate the patient’s recovery of heart function after a heart attack.

These findings advance the understanding of blood protein profiles during heart attack recovery and can potentially pave the way for better risk assessment and improve treatment decisions to reduce heart failure after MI.

Commenting on the progress of the study, A/Prof. Chan said, “Recent new technology enabled us to measure thousands of blood proteins at once and sequence tens of thousands of RNA fragments, in a fraction of the time required compared to conventional methods. We can move on to the next phase and possibly find new treatments that would hopefully prevent future occurrences of heart failure after a MI.”

“Strong and reliable signals, identifying those patients who are unfortunate enough to incur heart failure following a MI, remain an urgent need,” concurred Prof. Richards.

<sup>1</sup>**plasma** – The liquid portion of blood when the red blood cells, white blood cells and platelets are removed.

<sup>2</sup>**proteomics** – A large-scale study of proteomes which is refers to sets of proteins produced in an organism.

<sup>3</sup>**transcriptomics** – A comprehensive analysis of whole sets of RNA transcripts produced by the genome under specific circumstances or in a specific cell using high-throughput methods.

<sup>4</sup>**assay** – An investigation procedure to measure or assess the quantity of a target entity.



Heart attacks or MI affects about 10,000 Singaporeans every year.



Heart failure is the most common and severe complication of a heart attack.



Approximately 4.5% of people in Singapore are at risk of heart failure after a heart attack.



Only 32% of these patients survive after five years from their diagnosis.

#### ARTICLE BY

**Dr. Tan Sock Hwee**  
Senior Research Fellow, Department of Medicine, Yong Loo Lin School of Medicine, National University of Singapore (NUS)



Dr. Tan is a senior research fellow focused on cellular and molecular mechanisms in cardiovascular diseases with special interests in biomarker discovery, proteomics and lipidomics.

# THE FIRST HEART GENOMIC CONNECTOME

*A genetic map of the heart opens new ways of understanding heart disease*

**H**eat disease is the top cause of death worldwide. In Singapore, it accounts for one third of all deaths each year.

It is a complex set of diseases that is influenced by many different genes. To figure out the genetic basis of such complex diseases, researchers study how different parts of the genome (made up of both genes and the non-coding elements between them) physically interact with one another inside the tight, small space of the nucleus.

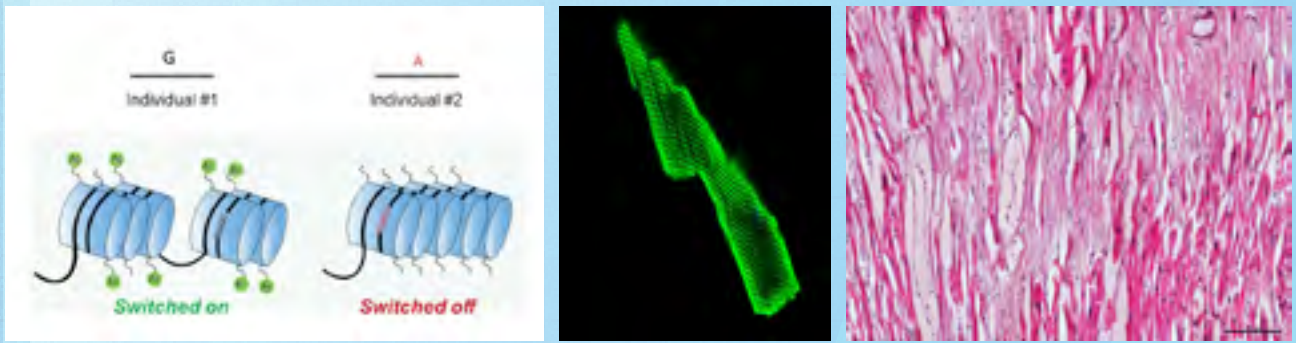
The human genome<sup>1</sup> is incredibly vast, as evidenced by the fact that a single human genome print-out occupies over a hundred volumes of minuscule text housed at the Wellcome Collection in London, the United Kingdom. Superimpose the network of physical contacts formed from the connections between different sections of a

single genome, and one will get a sense of the enormous challenge in understanding which interactions are important for a particular disease.

To help identify the important interactions involved in heart disease, Prof. Roger Foo, Senior Consultant at the National University Heart Centre, Singapore (NUHCS) as well as a professor at the Department of Medicine at National University of Singapore (NUS) Medicine has led a research team to develop the first heart genomic “connectome.” This connectome is a map of the genes in the heart and the “switches” that connect to and control them. This work was published as two companion publications in the journals *Circulation* and *Circulation Research*. The papers were co-first authored by Asst. Prof. Chukwumeka George Anene-Nze-lu, PhD students Mr. Wilson Tan and Mr. Mick Lee, as well as Dr. Eleanor Wong.

“Humans have the same number of genes as flies or worms—around 20,000,” explained Prof.





**Image 1** – These switches are in turn controlled by changes in the DNA code (either G or A in this example). Credit: Mick Lee

An image of a single cardiomyocyte<sup>2</sup> that makes up the heart muscle. Credit: NUS Medicine

A cross sectional view of the heart muscle. Credit: NUS Medicine

Foo. “What makes us more complex than a fly is that we have a lot more switches that turn these genes on or off.”

The switches are mostly in the non-coding elements in the genome, i.e. the portions of DNA between genes. They can be flipped on or off according to differences in the DNA code at the section of the switch called variants. For example, in one individual, a variant G may mean that the switch is flipped on. In another individual, a different variant A may mean that the switch stays off (see Image 1).

To make things more complicated, each gene has more than one switch, and these may be very far away from the genes they control, making it difficult to identify which switch controls which gene just from looking at the DNA code.

The connectome map developed by the NUS Medicine team shows where these switches are and pinpoints the most important switches for each gene in the map. Significantly, they found that a series of 59 new variants which influence key switches for particular genes may play important roles in the function of those genes in heart disease.

“Our connectome helps to make sense of the human genome by highlighting the sections and interactions that are relevant for various organs, such as the heart. This could make it possible to analyse the functions of the entire genome someday,” said Prof. Foo.

Asst. Prof. Anene-Nzeli adds, “Using the connectome, we were also able to identify new genes associated with heart disease. These could serve as targets for the development

of novel treatments for these diseases.”

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<sup>1</sup>**human genome** – Refers to the approximately three billion base pairs of DNA that make up the entire set of chromosomes of the human organism.

<sup>2</sup>**cardiomyocyte** – Also known as myocardiocytes, cardiomyocytes are cells that make up the heart muscle/cardiac muscle. As the chief cell type of the heart, cardiac cells are primarily involved in the contractile function of the heart that enables the pumping of blood around the body.

ARTICLE BY

**Prof. Roger Foo**  
Senior Consultant,  
Department of  
Cardiology, NUHCS



Prof. Foo is active in research with a special interest in inherited cardiac conditions and cardiovascular epigenetics and has been recognised for his work being an award recipient of the British Cardiac Society Philip White Fellowship, The Wellcome Trust Advanced Research Fellowship and The British Heart Foundation Intermediate Research Fellowship. He currently leads a team of researchers focused on cardiovascular epigenetics harnessing integrative technology at the Cardiovascular Research Institute (CVRI), National University Health System (NUHS) where he is also the Deputy Director (Basic Science Matters). He has also been recently appointed the inaugural Zayed Bin Sultan Al Nahyan Professor in Medicine from 1 November 2020 to 31 October 2023.





# IN THE LEAD

## *Initiating PASSivation of Vulnerable plaque with AZD5718 in acuTe coronary syndrome (PASSIVATE) trial*

**T**he National University Heart Centre, Singapore (NUHCS) has collaborated with AstraZeneca to initiate a multi-center study across 13 sites in 3 countries – Singapore, New Zealand and the United Kingdom with A/Prof. Mark Chan, Senior Consultant, Department of Cardiology, NUHCS as the principal investigator.

Targeting to recruit 360 patients with recent acute coronary syndrome<sup>1</sup>. PASSIVATE

is a randomised, double-blind, placebo-controlled Phase IIA trial that investigates how 12 months of treatment with AZD5718 modifies coronary plaque volume.

AZD5718 is a once daily orally-bioavailable<sup>2</sup> small molecule inhibitor of 5-lipoxygenase activating protein (FLAP)<sup>3</sup>. Inhibition of FLAP reduces the production of leukotrienes (pro-inflammatory lipid mediators mediating their effect primarily through white blood cells) which are associated with diverse acute chronic inflam-

mation and allergic diseases such as asthma, arthritis, dermatitis, atherosclerosis<sup>4</sup> and cancer. By blocking leukotriene production, AZD5718 may be used to treat these diseases.

The primary hypothesis being tested in PASSIVATE is that 12 months of treatment with AZD5718 reduces the progression of plaque formation when compared to the placebo effect.

The PASSIVATE trial delves deeper into the insight as two large clinical trials recently





published results showing that targeting a specific molecule involved in inflammation can greatly reduce the risk of adverse cardiovascular events in people with heart diseases by about 17 percent.

In the PASSIVATE trial, patients with recent ST<sup>5</sup> elevation myocardial infarction (STEMI)<sup>6</sup> or non-STEMI will receive an additional oral dose of AZD5718 (or a placebo) as the standard clinical care for 12 months.

Eligible patients who have given their consent to be in the study will need to undergo a computed tomography coronary angiography (CTCA)<sup>7</sup> at the start of the trial, and again, at the end of the treatment regime. They will also need to visit the clinic for follow-ups regularly with an additional follow-up visit four weeks after the last dose of their treatment to ensure their safety and well-being, having participated in the trial.

The trial starts in April 2021 and results from the trial are expected to be ready before end 2023. PASSIVATE is co-funded by a USD10 million grant from Astra-Zeneca and SGD3 million grant from Singapore's National Medical Research Council.

<sup>1</sup>**acute coronary syndrome** – Describes the range of various conditions associated with sudden, reduced blood flow to the heart, often associated with plaque buildup inside arteries causing abrupt limitations of blood flow, consequently leading to a heart attack or stroke.

<sup>2</sup>**orally-bioavailable** – Refers to a drug that is taken by the mouth which can be absorbed and used by the body.

<sup>3</sup>**FLAP** – A gene that has been recently linked to risk for myocardial infarction, stroke and restenosis (the recurrence of narrowing of blood vessels).

<sup>4</sup>**atherosclerosis** – a buildup of cholesterol-rich plaque inside arteries which is the root cause of most heart attacks and strokes.

<sup>5</sup>**ST** – ST is seen on an ECG reading, referring to a resting period of the heart during its conduction.

<sup>6</sup>**STEMI** – A more severe form of heart attack where the coronary artery is blocked off by a blood clot for a prolonged period of time affecting a large area of the heart.

<sup>7</sup>**CTCA** – An imaging test that looks at the arteries that supply blood to your heart using a powerful X-ray machine to capture images of your heart and its blood vessels.

ARTICLE BY

**A/Prof. Mark Chan**  
Senior Consultant,  
Department  
of Cardiology,  
NUHCS



A/Prof. Chan is also an associate professor at the Yong Loo Lin School of Medicine, National University of Singapore (NUS). He is a principal investigator at the Cardiovascular Research Institute, NUS and deputy director (clinical research) of the NUS Cardiovascular Disease Translational Research Program.

## Clinical trials conducted in humans usually go through 4 phases:

**Phase I** – Conducted in a small number of healthy volunteers to determine if the drug is safe for use in humans and how it behaves in the human body.

**Phase II** – Conducted on a small number of patients with the illness being researched upon. The objective is to explore the treatment efficacy of the drug to determine the dosage and further evaluate its safety.

**Phase III** – Conducted on a larger population of patients to demonstrate or confirm the treatment of the drug and to collect more data and information on the efficacy of the drug. These studies will be required for submission to regulatory authorities for product registration to be used widely.

**Phase IV** – Sometimes also known as post-marketing studies and conducted to gather additional information about the optimal use of the drug.

There are risks involved when participating in clinical trials. Always check with your doctor on your risks before participating in any trial.

# ★ Congratulations! ★

## SPECIAL RECOGNITION AWARD IN EDUCATION



**Dr. Sia Ching Hui**  
Senior Resident,  
Department of  
Cardiology, NUHCS

**Prof. Tan Huay Cheem**  
Director and Senior  
Consultant, NUHCS

The National University Heart Centre, Singapore (NUHCS), part of teaching hospital, National University Hospital (NUH), partners Yong Loo Lin School of Medicine, National University of Singapore (NUS) in creating an innovative immersive curriculum for medical students.

In evaluating teaching standards, graduating students are asked each year to nominate tutors who have

made a significant impact on their learning journey and respond to the question -- who are your role models during medical school and what have you learnt from them.

For AY1920, Prof. Tan Huay Cheem, Director and Senior Consultant, NUHCS, and Dr. Sia Ching Hui, Senior Resident, Department of Cardiology, NUHCS received the **Special Recognition Award**.

## NATIONAL MEDICAL RESEARCH COUNCIL (NMRC) AWARDS 2020



**A/Prof. Mark Chan**  
Senior Consultant,  
Department  
of Cardiology,  
NUHCS

NMRC presents awards to outstanding clinician scientists and researchers for their achievements and contributions to better healthcare outcomes.

Congratulations to A/Prof. Mark Chan, Senior Consultant, Department of Cardiology, National University Heart Centre, Singapore (NUHCS) who has won the **NMRC 2020 Clinician Scientist Award for Senior Investigator**.

## OUR NEWLY PROMOTED DOCTORS! FROM JANUARY 2021



**Dr Chang Guohao**  
Consultant,  
Department of  
Cardiac, Thoracic  
and Vascular Surgery



**Dr Ng Jun Jie**  
Consultant,  
Department of  
Cardiac, Thoracic  
and Vascular Surgery





The Stars@NUH Award is awarded to recognise staff across the various professional job groups at National University Health System (NUHS) who have made significant contributions and are deeply committed to making a difference to patient care.

*Congratulations to all our colleagues from the National University Heart Centre, Singapore (NUHCS) who received the award this year!*

**EXEMPLARY STAFF AWARD – MODEL**

**Mr. Alvin Timothy Tay Yong Meng**  
*Assistant Director*

**MODEL ALLIED HEALTH PROFESSIONAL AWARD – CLINICAL EFFECTIVENESS**

**Mr. Anand Kailasam**  
*Senior Medical Technologist*

**PATIENT SERVICE ASSOCIATE (PSA) AWARDS – FIRST IMPRESSION**

**Asnah Binte Ikhsan**  
*Patient Service Coordinator, Ward 28*

**EXEMPLARY STAFF AWARD – OUTSTANDING**

**Ms. Choo Hui Ting**  
*Senior Patient Service Associate*

**Mr. Clifford Xu De Sheng**  
*Assistant Nurse Clinician*

**Ms. Saraswathy d/o Nadarajan**  
*Staff Nurse I*

**Happy Retirement!**

Mrs. Goh Bok Lan, Principal Perfusionist, NUHCS retired at the end of 2020.

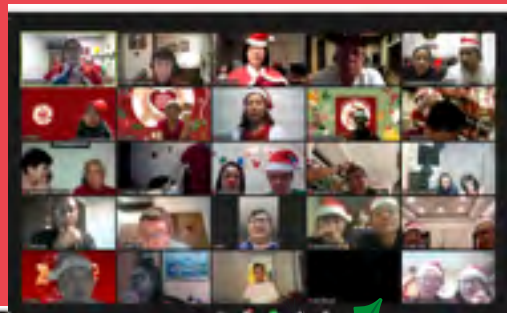
She is pictured here receiving a memento from A/Prof. Theodoros Kofidis, Head and Senior Consultant, Department of Cardiac, Thoracic and Vascular Surgery (CTVS), NUHCS and Prof. Lee Chuen Neng, Senior Consultant, CTVS, NUHCS.

Thank you for your years of service, Mrs. Goh!



**Caring Hearts Support Group (CHSG) Christmas Zoom Party**

More than 50 members shared their talents and wishes during CHSG 2020 annual Christmas gathering.



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## ABSTRACTS

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Coagulation Research in Pediatric ECMO: The Need for a Common Language



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