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Medical Sp  tlight

Integrated Heart Failure  
Programme @ National  
University Heart Centre,  
Singapore (NUHCS)

Heart Rhythm  
(Arrhythmia) Service -  
Reaching New Heights  
with Robotic Ablation

One Small Cut  
– Uniportal VATS

**Asst Prof John Tam Kit Chung**

Senior Consultant,  
Department of Cardiac,  
Thoracic and Vascular Surgery

Head,  
Division of Thoracic Surgery

# GPLC

NUH GP Liaison Centre



GP Appointment  
Hotline: +65 6772 2000

# About GPLC

At the National University Hospital (NUH), we recognise the pivotal role general practitioners (GPs) and family physicians play in providing and ensuring that the general public healthcare is of the highest quality and standard. As such, we believe that through closer partnerships, we can deliver more personalised, comprehensive, and efficient medical care for our mutual patients.

The **General Practitioner Liaison Centre (GPLC)** aims to build rapport and facilitate collaboration among GPs, family physicians and our specialists. As a central coordinating point, we provide assistance in areas such as patient referrals, continuing medical education (CME) training, and general enquiries about our hospital's services.

Through building these important platforms of shared care and communication, we hope that our patients will be the greatest beneficiaries.

If we could be of any assistance to you, please feel free to contact our office from Mon - Fri : 0900-1200hrs, 1400-1800hrs at:

## GP Hotline

Tel: +65 6772 2000

Fax: +65 6777 8065

## NUH Continuing Medical Education (CME) Events

At NUH, we strive to advance health by integrating excellent clinical care, research and education. As part of our mission, we are committed to provide regular Continuing Medical Education (CME) events for GPs and family physicians. These events aim to provide the latest and relevant clinical updates practical for your patient care.

Organised jointly by the GP Liaison Centre (GPLC) and the various clinical departments within NUH, our specialists will present different topics in their own areas of specialties in these symposiums, which are held monthly.

For more information on our CME events, you can go to [www.nuhcme.com.sg](http://www.nuhcme.com.sg) or scan the following QR code.





**Dr Raymond Wong**  
Senior Consultant,  
Department of Cardiology,  
National University Heart Centre,  
Singapore

Dr Raymond Wong is the Programme Director for the NUHCS Heart Failure Programmes in addition to his appointments of Director for Nuclear Cardiology and Cardiac Rehabilitation Programmes. He has special research interests in the fields of heart failure and cardiomyopathy. In addition, he is involved in many quality improvement projects within the hospital.

### What is Heart Failure?

Heart failure (HF) is a syndrome of multi-system/multi-organ dysfunction directly or indirectly caused by impairment to the ventricular functions. The cornerstone of HF is the elevated filling pressure to the right and left ventricles, best expressed as high right atrial pressure (RAP) and pulmonary capillary wedge pressure (PCWP). More often than not, the cardiac output (CO) is inadequate for the metabolic needs of the organs, or that it may be relatively insufficient for the degree of utilisation. The resultant pathophysiological changes are complex, but it can be best appreciated by renin-angiotensin-aldosterone-sympathetic system (RASS) activation. Increased plasma volume from salt and fluid retention eventually leads to volume overload, and pulmonary edema.

Some HF experts describe HF as 'cardio-renal anaemia syndrome', reflecting the vicious cycle dysfunctional ventricular pump functions have on the rest of the organ systems.

Based on the left ventricular contraction fraction of the left ventricle, HF can be differentiated as:

- HFrEF (heart failure with reduced ejection fraction less than 40%)  
The problem lies in ineffective contraction – less oxygen-rich blood is pumped to the rest of the body as the heart muscle in the left ventricle does not contract with sufficient force.
- HFpEF (heart failure with preserved ejection fraction more than 40%)  
The problem lies in ineffective

relaxation – this causes less blood to enter the heart as the ventricles do not relax properly even when the heart contracts normally.

### How do we make the diagnosis of HF?

Diagnosis of HF is essentially clinical, i.e. based on history and physical examination. European Society of Cardiology Acute and Chronic Heart Failure Guideline in 2012 detailed the following, shown in Table 1 below:

There are however less typical or common presentation of HF, such as bloated feeling and night coughs.

### How do we investigate?

An in-depth understanding of patients' cardiovascular performance is important to establish accurate diagnosis and for guiding targeted optimal treatment for HF patients. Invasive and non-invasive functional (Refer to Table 2 on page 4) and blood circulation evaluations with the use of laboratory tests, echocardiography

or even pulmonary artery catheter (PAC), among others, may be performed to fine-tune diagnostic intricacies of complex syndromes; functional studies such as cardiopulmonary stress test (CPET) – a non-invasive assessment of a patient's cardiovascular and respiratory system during exercise, may be indicated to determine exercise capacity and determine prognosis. Finally, perfusion stress test and coronary angiography may be required to determine the role of CAD in causing HF.

### The principle of management – therapy

Based on established international guidelines, there are categories of therapeutic drugs that are 'mandatory' in HF due to their proven efficacy. These include beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, Angiotensin II receptor blockers, mineralocorticoid receptor antagonist, specific funny-channel inhibitor (ivabradine), and digitalis. Anti-platelet and anti-coagulation drugs are frequently prescribed according to indications.

# Integrated Heart Failure Programme @ National University Heart Centre, Singapore (NUHCS)

Symptoms	Signs
Typical	More specific
Breathlessness	Elevated jugular venous pressure
Orthopnoea	Hepatojugular reflux
Paroxysmal nocturnal dyspnoea	Third heart sound (gallop rhythm)
Reduced exercise tolerance	Laterally displaced apical impulse
Fatigue, tiredness, increased time to recover after exercise	Cardiac murmur
Ankle swelling	

Source: *European Heart Journal* (2012) 33, 1787-1847, *European Journal of Heart Failure* (2012) 14, 803-869

Table 1. Signs and symptoms of HF

Non-invasive methods
<ul style="list-style-type: none"> <li>• Electrocardiogram</li> <li>• Chest X-ray</li> <li>• Laboratory tests including renal and liver function, full blood count, iron studies</li> <li>• Cardiac biomarkers including BNP ^</li> <li>• Echocardiography</li> <li>• Myocardial perfusion imaging</li> <li>• Stress echocardiography</li> <li>• Cardiac magnetic resonance imaging (CMR)</li> <li>• Cardiopulmonary exercise test</li> <li>^ Brain natriuretic peptide</li> </ul>
Invasive methods
<ul style="list-style-type: none"> <li>• Right heart study</li> <li>• Coronary angiography</li> <li>• Endomyocardial biopsy</li> </ul>

Table 2. Invasive and non-invasive methods for treatments of HF patients

In addition to guideline-driven drug-based optimal medical therapy, the National University Heart Centre, Singapore (NUHCS) HF Programme is also equipped with capabilities of implanting medical devices such as cardiac resynchronisation therapy (CRT) and automatic implantable cardioverter defibrillator (AICD) in suitable candidates to achieve clinical benefit beyond drugs. Atrial fibrillation and ventricular tachycardia ablation can also be performed if these rhythm disturbances are directly contributing to HF control.

#### The emphasis of the NUHCS HF Programme comprises:

- Seamless, coordinated care from multiple disciplines.
- Nurse-led phone-based telemonitoring of clinical progress and remote telemonitoring of body weights.
- Pharmacy-led Medication Titration and Monitoring Clinic as well as Medication Titration and Reconciliation Clinic.
- Close networking with arrhythmia clinics, for optimal management of electrical conduction abnormality and implantable device optimisation.
- Heart failure cardiac rehabilitation where the emphasis is to help symptomatic HF patients return to an active and satisfying life via supervised exercises, and to empower them via counselling and education to better manage their heart disease as well as medications.

- *Incorporation of research and clinical databases to advance the boundary of clinical knowledge. Patients and caregivers occupy the centre of a complex matrix of healthcare disciplines.*

#### How do we measure the outcome?

NUHCS HF programme is designed to provide the highest quality of care to patients. Guideline-based medication utilisations are tracked to ensure 100% compliance to the international guideline recommendations. Clinical outcome events such as 30-day and 6-months re-admissions, inpatient and intermediate-term deaths are tracked constantly to ensure the best outcome for the patients.

#### Role of a GP for a heart failure patient

Family physician plays an important role in the holistic care of a HF patient. They can provide patient care 'closer to home' and improve patient satisfaction, assist in appropriately treat HF patients according to guidelines given the longer wait time at the institutions, avoid unnecessary emergency heart failure and atrial fibrillation (AF) admissions through early medical attention and treatment, improve current HF and AF knowledge base among patients and family members and, last but not least, provide timely 'end-of-life' discussion.

#### Final Word

The holistic management of HF must include aggressive lifestyle modifications. These consist of smoking cessation, regulation of salt and fluid intake, and adoption of calibrated exercises wherever possible. Additionally, adopting and maintaining an optimistic view of HF outlook is critical in fighting off negative sentiments and depression. Above all, family members and loved ones play a crucial role in supporting HF patients through thick and thin of the disease.

#### Our Heart Failure Programme

The National University Heart Centre, Singapore Heart Failure (NUHCS HF) Programme is built on a multi-disciplinary, holistic healthcare delivery platform to care for patients with HF syndromes. The programme consists of HF physicians, HF nurse coordinators, pharmacists, physiotherapists, and psychiatrists, working in close relationship with dietitians and specialists from other disciplines such as pulmonologists and endocrinologists. We, in particular, work closely with our psychiatry and palliative care colleagues to better manage advance bodily symptoms and alleviate depressive moods.

The sub-programmes of NUHCS HF include Heart Failure with Preserved Ejection Fraction (HFpEF) clinic, HF Rehabilitation Programme, HF Arrhythmia and Devices Clinic, and Cardiomyopathy Clinic. The diversification and sub-specialisation of the umbrella NUHCS HF Programme enhances and streamlines the comprehensive approach to diagnostics, therapy and rehabilitation of HF syndromes of all kinds.

The cornerstones of the NUHCS HF Programme are the HF specialist-run multi-disciplinary clinics. These consist of new case as well as follow-up and discharge clinics to address the specific clinical needs of HF patients. Specialised pharmacy clinics are also created, focusing on better understanding of the prescribed drugs, drug-drug interactions, and compliance of patients and care-givers.





**Dr Seow Swee-Chong**  
Senior Consultant,  
Department of Cardiology,  
National University Heart Centre,  
Singapore

Dr Seow Swee Chong is the Programme Director of the Heart Rhythm Programme (Arrhythmia Service) at NUHCS. Apart from general cardiology, Dr Seow's sub-speciality interests include heart rhythm disorders (arrhythmias), pacemaker, loop recorder and cardiac defibrillator implants as well as cardiac resynchronization therapy for heart failure.

Heart rhythm disorders (arrhythmias) are common in patients with cardiac disease. While medication had been the mainstay of therapy in the past, electrophysiologic study and radiofrequency ablation have become the treatments of choice for some types of arrhythmias since the late 1990s.

Patients with arrhythmias often present first to the family doctor with complaints of "palpitations", a sensation of irregular heart beat or fast heartbeat. A simple ECG performed by the doctor during the time of symptoms will identify the causative rhythm disorder if it is indeed the culprit.

The commonest arrhythmia in clinical practice is atrial fibrillation (AF). This is a condition in which the top chambers (atria), instead of contracting in a coordinated fashion to push blood into the bottom chambers (ventricles), "fibrillates" or enters into a state of fast and uncoordinated contraction. As a result, there is no effective movement of blood and this stasis predisposes to the formation of blood clots within the atria. If these clots dislodge and block up the blood vessels in the brain, a stroke is the result. Patients who have AF and who are deemed to be at high risk of stroke should receive blood thinning medications to reduce this risk. This is the most important aspect of AF management, and can be initiated by the family physician. Apart from the increased stroke risk, AF can result in a sensation of fast/

# Heart Rhythm (Arrhythmia) Service - Reaching New Heights with Robotic Ablation

irregular heartbeat, shortness of breath or pounding in the head. These can sometimes be controlled by medication, but if medications fail or are not preferred, radiofrequency ablation to eliminate the AF is a therapeutic option.

Palpitations can be the result of other rhythm disorders other than AF. This includes SVT (supraventricular tachycardia), atrial flutter, atrial tachycardia; and ventricular tachycardia. They can also be due to early (premature) beats originating from the atria or ventricles.

Arrhythmias resulting in an abnormally fast or irregular heart rhythm are often due to an electrical "short-circuit" within the heart. They can also result from a certain part of the heart muscle firing electrically on its own when it is not

supposed to. An electrophysiological (EP) study enables the doctor to locate precisely these areas of "short-circuit" or abnormal electrical activity. Radiofrequency energy can then be delivered through a catheter ("electrical wire") to interrupt the short-circuit or eliminate the areas of abnormal activity by heating up the heart tissue (a procedure known as "ablation"). This procedure effectively cures the patient of the arrhythmia in the vast majority of cases.

### Ablation Procedures

Ablation procedures are usually done manually. Using X-rays as a guide, the doctor manipulates and positions the catheters ("wires") in different locations within the heart by hand. This requires manual dexterity and skill to accomplish, and is thus operator-dependant. Procedures done manually may also

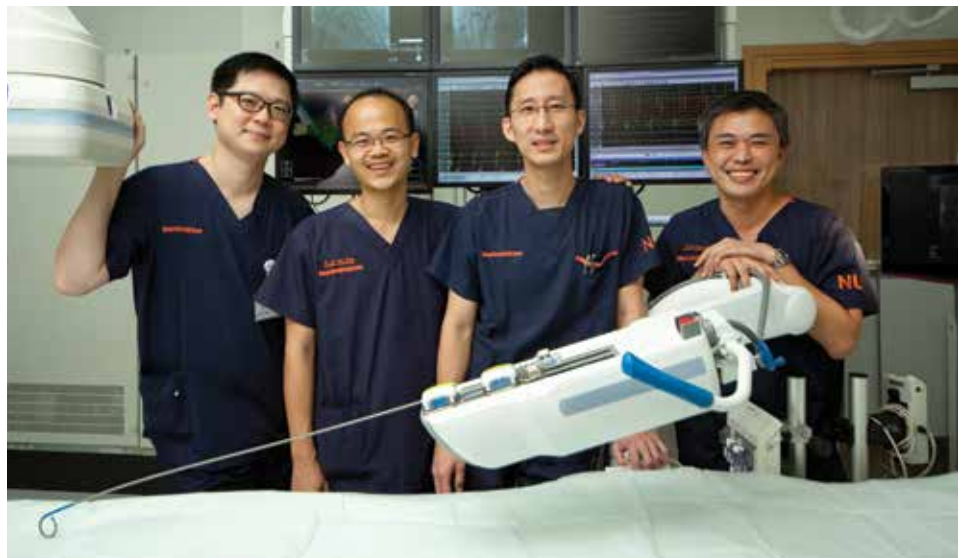


Figure 1. NUHCS AF Management Team



Figure 2. The Hansen Sensei-X System



Figure 3 & 4. Catheter ablation using the Hansen Sensei-X System



be plagued by issues such as difficulty manoeuvring catheters to certain inaccessible locations in the heart; and difficulty maintaining catheter stability in a beating heart in order to deliver radiofrequency energy accurately to the correct intended location. Precise positioning is crucial to the success of an ablation procedure; as well as to prevent procedural complications.

#### Electrophysiology Procedures

Electrophysiology procedures are complex; often lasting for many hours. Catheters within the heart also have to be moved from one location to another during the procedure, and this requires the use of X-rays to visualise the catheters in the body.

What this translates into is exposure of the patient and hospital staff to potentially large doses of radiation from these long procedures. Wearing heavy protective lead-lined gowns for many hours also increases the chance of musculoskeletal injuries in hospital staff.

#### Robotic Catheter Ablation Service

Remote catheter navigation has emerged in recent years as a solution to some of these issues. The National University Heart Centre, Singapore (NUHCS) has started a new robotic catheter ablation service using the Hansen Sensei-X system. This uses a mechanical robot to manipulate the ablation catheter within the heart, controlled remotely by the doctor using a 3-dimensional joystick via a dedicated computer system. It offers vastly superior catheter stability as well as precision since very small catheter movements can be made by the operator, whose hand movements are scaled 4:1 by the robot. This translates into potentially higher success rates, shorter procedure times and fewer complications for ablation procedures. It also makes ablation procedures less operator-dependant.

The robot is used in conjunction with an electro-anatomical mapping system, which creates a 3-dimensional "shell" or map of the heart chambers. This map is used to guide the robotic catheter to different locations in the heart without having to use X-rays. As such, exposure

of the patient and hospital staff to harmful radiation is greatly reduced. Meanwhile, the risk of occupational musculoskeletal injuries is also reduced without the need for staff to don heavy lead-lined gowns.

#### The Hansen Sensei-X System

Our experience with the robotic remote navigation system for catheter ablation has been positive. The Hansen system allows for very controlled and precise positioning of catheters, which can be manipulated to locations normally very difficult to be reached by hand. An added advantage we experienced with the Hansen system was that, for the same complex procedure using the same amount of time, the amount of radiation we were exposed to was only a tiny fraction as compared to conventional methods.

The initiation of the new robotic catheter ablation service at the National University Heart Centre, Singapore is a significant milestone in our quest to utilise the most recent technology to deliver the best possible care to our patients with complex cardiac conditions, as befits our standing as a tertiary medical centre.



### A/Prof Theodoros Kofidis

Senior Consultant,  
Department of Cardiac, Thoracic  
and Vascular Surgery  
Head, Division of Adult Cardiac  
Surgery, National University Heart  
Centre, Singapore

Associate Professor Theodoros Kofidis is a cardiothoracic surgeon specialising in minimally invasive repair/replacement of the heart valves. He promotes and offers a wide range of less invasive, small-incision and keyhole access procedure to minimize trauma and stress to the patient which he incorporates into the robotic cardiac surgery programme at the NUHCS which he started. He also has a considerable contribution to heart-related research which have earned him prestigious international awards.



### Dr Chang Guohao

Registrar,  
Department of Cardiac, Thoracic  
and Vascular Surgery,  
National University Heart Centre,  
Singapore

Dr Chang Guohao is a registrar undergoing his advanced specialty training in cardiothoracic surgery. He has completed his basic surgical training and is currently a member of the Royal College of Surgeons of Edinburgh.

Coronary artery bypass surgery (CABG) has evolved over the last 50 years since the development of the cardiopulmonary bypass machine by Gibbons in the 1950s. The progress of percutaneous coronary intervention (PCI) research and development of stents with improved qualities and evolution of CABG led to the birth of the new concept of hybrid revascularisation. In the past, median sternotomy to access the heart for CABG has been the gold standard. In the recent years, modern technology has brought about the possibility of minimally invasive cardiac surgery, in particular minimally invasive direct coronary artery bypass surgery on selected accessible target coronary vessels and simultaneous PCI to other culprit lesions. This collaborative approach has led to cardiothoracic surgeons and cardiologists working hand in hand to improve overall patient care – the important role of the ‘heart team’.

# The Advent of a New Era in Coronary Revascularisation

With the advent of minimally invasive cardiac surgery in the ever evolving field of cardiac surgery, coronary revascularisation has taken a new look. No longer is the patient with multi-vessel coronary artery disease faced with a limited option, he’s now presented with the attractive alternative of hybrid revascularisation.

The major therapeutic and survival benefits of coronary artery bypass graft (CABG) surgery over PCI are related to the use of the left internal mammary artery (LIMA) to bypass the left anterior descending (LAD) artery irrespective of its lesion complexity<sup>1</sup>. A major limitation of CABG with the saphenous vein graft (SVG) lies in graft failure rates of a range of 13% to 29% at 1 year and up to 50% at 10 years after surgery<sup>2-4</sup>. Data shows that restenosis rates, stent thrombosis rates of drug-eluting stents in non-LAD lesions are much lower at <10% and <1% respectively<sup>5,6</sup>. From a patient’s perspective, PCI has the advantage of being minimally invasive – less pain, faster return to normal basic functionality and much lower risk of complications, e.g., stroke<sup>7</sup>. This desire to combine the superior patency rate of the surgical LIMA to LAD graft with the low restenosis rate of PCI to non-LAD lesions led to the birth of the concept of hybrid revascularisation.

Hybrid coronary revascularisation (HCR) aims to enable the surgeon to perform, within the patient’s closed anterior

chest, a revascularisation configuration equivalent to that of a regular coronary artery bypass graft surgery without the need for a sternotomy, and in most patients, without the use of cardiopulmonary bypass, in a minimally-invasive fashion.

According to the definition from the American Heart Association and European Society for Cardiology, HCR for multi-vessel disease is defined as planned, intentional combination of the LIMA to LAD grafting and a catheter-based intervention to one or more non-LAD coronary arteries during the same hospital stay. This can be performed concurrently in a hybrid operating room in a single operative setting (same stop hybrid revascularisation) or can be performed in two different stages, separated by hours to a few weeks, often during the same hospital stay<sup>8</sup>. This is especially useful in patients with multi-vessel coronary artery disease.

In the simultaneous HCR, revascularisation of the LAD coronary artery can be performed by conventional minimally invasive direct coronary artery bypass (MIDCAB) technique or ideally by a robotically assisted endoscopic approach<sup>9,10</sup> after the LIMA has been harvested as a pedicle under direct vision. The PCI was then performed after closure of the thoracotomy. Angiography was then done to confirm patency of the LIMA-LAD graft and followed by PCI to the non-LAD lesions. Anti-platelet





Figure 1. The hybrid operating theatre



Figure 2. All Prof Kofidis and Asst Prof Edgar Tay with patient

management is important in the success of the procedure. At the same time, balance against risks of bleeding is paramount. Traditionally, low-dose aspirin of 100 mg/day was continued perioperatively, while clopidogrel was discontinued 7 days or more before the procedure. After angiographical confirmation of LIMA-LAD patency, a 300-mg loading dose of clopidogrel was administered so as to achieve peak concentrations to coincide with the deployment of the stent which will be placed after administration of unfractionated heparin.

HCR is a Class IIa recommendation with Grade B level of evidence for patients with limitations to conventional CABG, absence of adequate conduit or an unfavourable LAD for PCI.

HCR achieves the proven long-term survival benefit and symptomatic relief afforded

by a LIMA-LAD bypass graft. Moreover, the introduction of drug-eluting stents with reduced rates of restenosis and better clinical outcomes have made HCR a more sustainable and feasible option than previously reported<sup>10,11</sup>. The long-term survival benefit from the LIMA to LAD graft has been proven in many studies. The superior patency of the LIMA to LAD graft provides prophylaxis against future proximal LAD lesions, thereby translating into better event-free survival and relief on angina<sup>12</sup>. Kiali et al.<sup>13</sup> performed hybrid revascularisation on a total of 96 patients from 2004 to 2012, involving robotic-assisted LIMA harvesting and a left anterior thoracotomy for off-pump CABG for the LAD, followed by PCI to a non-LAD vessel in the hybrid operating theatre in the same session. This was done in 94 out of the 96 patients (two requiring intraoperative conversion to conventional coronary bypass).



Median post-operative length of stay was 4 days with a range of 3-9 days. Coronary angiogram done at 6-month follow-up in 85 patients showed 94% LIMA-LAD patency rate. Of the 105 stents deployed (89 drug-eluting stents and 16 bare metal), 79 stents were widely patent; 8 had in-stent restenosis and 2 were completely occluded. Five-year clinical outcome showed 91% survival. 94% of patients were free from angina. 87% of patients did not require any form of coronary revascularisation. This study demonstrated that single-stage hybrid revascularisation strategy can achieve good angiography patency results. In addition, survival, freedom from angina and further revascularisation are favourable over the 5-year clinical follow-up.

Repossini et al.<sup>14</sup> looked at 100 consecutive patients who underwent HCR. He managed to show that HCR is a viable option over conventional strategies of revascularisation in high risk patients. There was no in-hospital mortality. In addition, the overall freedom from Major Adverse Cardiac and Cerebrovascular event (MACCE) rate

was 82.6%. In addition, HCR resulted in better outcomes when performed on patients with a SYNTAX score of 22 or less.

McGinn et al.<sup>15</sup> demonstrated the use of minimally invasive strategy to revascularise multiple myocardial territories, namely the anterior, lateral and inferior myocardial territories. This allows for the feasibility of surgical revascularisation of the vessels which may not amenable to PCI, thereby offering an expansion of the types of patients suitable for the hybrid revascularisation programme. The ability to surgically revascularise the artery other than the LAD allows PCI to be carried out on one vessel and the remaining two receiving internal mammary artery / saphenous vein grafts. These territories were accessed via the 5th left intercostal space through a 4-6 cm thoracotomy. The coronary targets were stabilised using a positioner and epicardial stabiliser. The team successfully showed that multi-vessel minimally invasive CABG can be done safely and effectively with excellent short term outcomes. In the first 450

consecutive patients done via this technique, complete revascularisation was achieved in 95% of patients. Perioperative mortality was 1.3% (compared to 2.5% in conventional CABG) and the risks of conversion to sternotomy and cardiopulmonary bypass were 3.8% and 7.6% respectively.

HCR has gained popularity in more recent years. It allows for sternal preservation in the treatment of patients with multi-vessel coronary artery disease. In addition, it avoids the detrimental consequences of cardiopulmonary bypass, overall decreased need for blood transfusions<sup>16</sup> and results in faster recovery and a reduced length of stay in hospital<sup>16-18</sup>. Short and mid-term outcomes of mortality and morbidity have been favourably demonstrated<sup>19,20</sup>.

A recent comprehensive meta-analysis<sup>21</sup> by Harskamp et al. showed that HCR is associated with improved outcomes. A total of 1190 patients across 6 observational studies were analysed. The team demonstrated that HCR resulted in lower in-hospital need for blood transfusions, shorter length of stay and



Figure 3. The team during the surgery

a faster return to work. There were no significant differences for the outcomes of all-cause mortality and myocardial infarction during hospitalisation and a 1-year follow-up. LIMA-LAD patency rates were excellent at >95% among highly specialised centres<sup>21</sup>.

HCR has also been studied by Harskamp et al. in two sub-groups of patients with the diabetics<sup>21</sup> and the elderly<sup>22</sup>. In each sub-group, the team studied the differences in outcomes between HCR and CABG. He has demonstrated that HCR is a safe and beneficial procedure in diabetic patients with multi-vessel disease. In this sub-group of patients (618 over a 10-year period), when compared with diabetics who received CABG, the former group experienced lower chest tube drainage,

required less blood products and had a shorter length of stay. Over a 3-year follow-up period, the mortality was similar between the two groups. In the sub-group of elderly patients above 65 years of age, HCR resulted in fewer procedural complications, fewer blood transfusions, less chest tube drainage and shorter length of stay.

The strategy of hybrid revascularisation requires close cooperation between the cardiac surgeon and the interventional cardiologist. Practical and logistical concerns are present. They implicate the need for the formation of a 'Heart Team'<sup>23</sup>, so as to better manage the patient in terms of sequencing and timing of procedures as well as the use of aggressive anticoagulant therapy for PCI

that may worsen the bleeding in the surgical patient.

Early and mid-term results of HCR are promising. This technique combines the advantages of the LIMA to LAD graft with the superior patency of drug eluting stents compared to SVGs on the non-LAD lesions. The HCR procedure is an attractive alternative to conventional CABG with evidence of reduced MACCE, reduced 30-day mortality rates, reduced transfusion requirements, shorter hospital length of stay, high post-operative LIMA patency rates, and high survival rates. Use of the hybrid approach is justified, especially with meticulous patient selection and very importantly, close cooperation between cardiac surgeons and interventional cardiologists of the 'Heart Team'.

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**Dr Julian Wong**  
Senior Consultant,  
Department of Cardiac, Thoracic  
and Vascular Surgery

Head,  
Division of Vascular Surgery,  
Department of Cardiac, Thoracic  
and Vascular Surgery,  
National University Heart Centre,  
Singapore (NUHCS)

Dr Julian Wong is the Programme Director for Vascular Medicine and Therapy Programme at NUHCS. He has extensive experience in both open and endovascular surgery, including complex aortic aneurysms, carotid disease and peripheral vascular disease as well as redo surgery. Dr Wong has special interests in aortic aneurysm surgery, treatment of diabetic foot, varicose vein treatment and more.

Varicose veins are unsightly dilated and tortuous veins along the superficial venous system in the legs. Patients often come to consult their doctors due to their appearances. The majority of the veins at early stage are asymptomatic. The most common problem people encounter is pain. However the "pain" described is usually a heaviness or deep ache experienced at the end of the day. It is important that efforts must be taken to elicit for other causes of pain.

Swelling is another common problem with more advance varicose veins. This is more difficult to treat, and treatment does not necessary stop leg swelling. This can also be caused by lymphoedema for the older population. Swelling is also a complication of varicose veins especially during the treatment of recurrent varicose veins.

Varicose veins can cause bleeding when it ruptures. The bleeding can be torrential and normally, the patient will present themselves to the emergency department. This does not require hospital admission but just pressure dressing and bandages.

Thrombophlebitis is another complication of varicose veins. Sometimes, it is mistaken for cellulitis and treated with antibiotics. The correct treatment should be a non-steroidal anti-inflammatory drug (NSAID), paired with compression stocking. This condition is usually very painful and takes a few weeks for recovery. During this time, patient reassurance is very important.

Last but not least, varicose veins will produce skin changes. This can be presented in the way of varicose eczema, lipodermatosclerosis and skin ulceration.

Thrombophlebitis, bleeding and skin changes are clear indication for specialist referral and definitive treatment of varicose veins.

The treatment of varicose veins is based on the treatment of faulty superficial systems, the long saphenous (LSV) or the short saphenous system (SSV).

### Stages of disease

Varicose veins and chronic venous insufficiency (CVI) are normally classified using the CEAP classification. This method provides information on the clinical severity, etiology, anatomical location and pathophysiology. For practical purpose to rationalise treatment based on literature evidences to decide whether the patient requires intervention, the clinical severity score is most useful (C1 to C6).

- C 1 = spider veins
- C 2 = varicose veins
- C 3 = varicose veins with oedema

# Comprehensive Vascular Health services at NUHCS

- C 4 = lipodermatosclerosis/ skin changes / varicose eczema
- C 5 = healed ulcer
- C 6 = non healing ulcer

Spider veins (C1) treatments are really cosmetic. Treatment is administered either with injections using sclerosing agent like Fibro vein (1-3%) (STD), hypertonic saline or superficial laser treatment. However, this treatment is rather time consuming.

Varicose veins (C2-3) (with or without leg oedema) treatments are mainly given to improve quality of life for the patients. Care must be taken to obtain



Figure 1. Foot ulcer

a very detailed history so that when communicating to the patients, a realistic expectation can be given. The most common misconception with patients is that the varicose veins which presents on their legs are the main cause of their symptoms of pain. Quite commonly in my practice, I see patients with sciatica, knee joint pain, muscular problems and they frequently think that their main symptoms are caused by varicose veins. These are always elicited after a thorough history and examination.

Lipodermatosclerosis (C4) is the next step of progression in varicose veins. The presentation of fairly dark brown skin patches at the gaiter area on the medial side is common. The patient must be told that the skin colour is irreversible even after treatment. Sometimes the skin changes can be at the lateral aspect; this merely indicates a short saphenous problem.

Ulceration is a huge problem (C5-6). The priority treatment is to heal the ulcer first with compression bandages. The ulcer should be tested for microbiology culture and treated with antibiotics accordingly. This should be referred to specialist vascular clinic for attention. The treatment of the CVI will only prevent recurrence of ulceration but has no bearing on healing of the ulcer (ESCHAR study)<sup>3</sup>.

### Investigations

After clinical examination, some doctors use the hand-held Doppler to check for incompetence of the sapheno-femoral or saphenopopliteal junction. However, this does give any further information beyond that. The recommended investigation of choice is Duplex ultrasound in a recognised vascular lab in a specialist unit<sup>1</sup>. This allows for assessment of all the incompetent systems of both superficial and deep venous system as well as perforator problem. The specialist vascular surgeons can then advice the patient accordingly. Duplex is also at advantage to other modalities as it can

demonstrate functionally problem. It can recognise previous DVT and see old scarred thrombus clearly on the veins. Venogram or CT and MR cannot offer any dynamic assessment.

### Treatment

Previously, conservative treatment with class 2 compression stockings is used for people who do not want surgery. However, recent NICE guidelines suggested that the evidence is weak in terms of stopping the progression of varicose veins. It suggested that all varicose veins should be treated. Nevertheless, the stockings do offer symptomatic relief.

The principle of the treatment is ablating the relevant superficial system in relation to the varicose veins. Currently there are three modalities of treatment. First, we have the traditional method of surgery with high-tie ligation of sapheno-femoral with stripping of LSV to the knee and multiple avulsions for long saphenous problem. For short saphenous issues, it will be the ligation of sapheno-popliteal junction without stripping due to high incidence of injury to the sural nerve.

Secondly, in the last 10 years, endovenous techniques have taken over as the preferred choice of treatment by patients and doctors. Usually, a guide wire is inserted just below the knee into the long saphenous vein under ultrasound guidance. The long saphenous vein is cannulated with the laser or radio frequency device up to the junction and then the whole system is ablated with heat. Some surgeons will do the avulsions below the knee in the same sitting to prevent the patient from coming back a second time. If you only treat the system without avulsions of varicosities, there is a 30% chance that the varicosities may not settle down completely after 6 to 8 weeks. Recently, another endovenous method is being used - a probe injects sclerosing

## References

- 1) UK National Institute for Health & Care Excellence Guidelines on Varicose veins in the Legs July 2013
- 2) The care of patients with varicose veins and associated chronic venous disease : Clinical practice guidelines of the Society for Vascular surgery and the American venous Forum
- 3) Barwell JR1, Davies CE, Deacon J, Harvey K, Minor J, Sassano A, Taylor M, Usher J, Wakely C, Earnshaw JJ, Heather BP, Mitchell DC, Whyman MR, Poskitt KR. Comparison of surgery and compression with compression alone in chronic venous ulceration (ESCHAR study): randomised controlled trial. *Lancet*. 2004 Jun 5;363(9424):1854-9

agent into the LSV to irritate the system for thrombosis (Clarivein). The main advantage is that it does not require large amounts of local anaesthetic for this method and can be done entirely outpatient. However, we do not have any Level 1 evidence that this is better than the other two.

Lastly, you can use foam sclerotherapy to inject the whole system including the varicosities. The efficacy is not as good as the two above-mentioned, but it is the least invasive of three.

So, which method should we offer the patients? There are a few considerations. In Singapore, our healthcare system is fee-paying and surgery is the cheapest and most cost-effective. However, in the USA or UK, the latest recommendation would be the endovenous method using laser or radio frequency as first treatment, followed by foam sclerotherapy and then surgery<sup>1,2</sup>. Recent evidence from a multicentre in the CLASS study suggests that surgery is as effective as endovenous and that foam sclerotherapy is not cost-effective at all. This may change the guidelines for the coming year.





**Asst Prof John Tam Kit Chung**  
Senior Consultant,  
Department of Cardiac, Thoracic and  
Vascular Surgery  
Head, Division of Thoracic Surgery,  
National University Heart Centre,  
Singapore (NUHCS)

Assistant Professor John Tam is a cardiothoracic surgeon who performs the full spectrum of thoracic surgery, including diseases in the lung, mediastinum, pleura, chest wall, and diaphragm. He specialises in performing minimally invasive keyhole surgery using advanced Video-Assisted Thoracoscopic Surgery (VATS) techniques, and has pioneered new techniques in Uni-Port VATS (UP-VATS) or Single Incision Thoracoscopic Surgery (SITS) to perform lung and chest surgeries.

Lung Cancer continues to rank among the top three cancers diagnosed in men and women in Singapore. If it is discovered early, it can be excised via lobectomy, the process of opening the chest to remove cancerous lung tissue and lymph nodes.

Introduced in the 1990s, video-assisted thoracoscopic (VATS) lobectomy is a minimally invasive technique developed to reduce post-operative pain in patients. Surgeons may previously have had to cut through muscle and bone in traditional open surgery, but they now need to make only three to five incisions through which a tiny camera and other surgical instruments are inserted to get to the diseased tissue. Despite these improvements, patients still take about a month before they can resume normal activities.

Concerned about the pain patients suffer after conventional VATS operations, Dr John Tam, Head of Thoracic Surgery at the National University Heart Centre, Singapore (NUHCS), set out to refine the VATS technique.

## One Small Cut – Uniportal VATS

In 2009, he made a breakthrough using a single three-centimetre incision that became the uniportal VATS (UVATS) lobectomy. “The single-port access method means we only make one small cut, and all the muscle tissue and ribs are totally spared,” says Dr Tam. With UVATS, patients resume regular activities within a week and are almost pain-free, needing only oral analgesia to relieve mild pain. Patients that underwent UVATS has reported to have been able to stand up and walk right away after regaining consciousness, and without any painkiller administered.

Because of better recovery rates, Dr Tam could now reach out to older and weaker patients who would otherwise not have qualified for surgery before. He has since helped many patients whom are in their

60s and 70s. The oldest is nearly 87 and made a successful recovery.

Dr Tam is eager to promote the use of the technique he developed and has taken to teaching others how to perform it — fewer than five surgeons in the world have adopted the single-incision method. The NUHCS is pioneering this latest technique, being one of the centres in the world that routinely offers UVATS to lung surgery patients.

Minimising risk, however, is still the main priority in surgery. If a lung tumour is too large, using the single-incision technique may not be appropriate. In that case, Dr Tam would opt for traditional methods. “The ultimate goal is to do a safe and good operation while optimising the patient’s recovery,” Dr Tam stresses.



Figure 1 & Figure 2: uVATS incision scars

## DOCTOR'S HEARTBEAT

Dr Kristine Teoh studied in England and graduated from Cambridge University. She undertook her Basic Surgical Training in England, completing her FRCS (Eng.) in 1996. As expected of all Cardiothoracic Surgery trainees in the UK, she took a 3-year break from clinical work to pursue a postgraduate research degree at University College London, completing her thesis and achieving her MS (Lon.). Thereafter, she underwent Specialist Registrar Training in Cardiothoracic Surgery, completing her FRCS (CTh) in 2007.

Dr Teoh trained at a number of prestigious cardiothoracic units in London and acquired a broad experience in adult cardiac and thoracic surgery. After completing her FRCS (CTh), she pursued her subspecialist interests with postings in Aortic Surgery and then a Fellowship in Mitral Repair Surgery, as well as undertaking a Locum Consultant post before returning to Singapore. In 2009, Dr Teoh returned to Singapore and is now a Senior Consultant at the National University Heart Centre, Singapore.

Presently, her clinical interests include coronary artery surgery, valve replacement and repair, aortic root and thoracic aortic surgery, and transcatheter therapies. Her other interests include cardiac surgery in the elderly; quality of life following cardiac surgery; implementing and sustaining high quality healthcare provision; research, innovation and training in cardiac surgery.

### *Specialist in Focus*

# Dr Kristine Teoh

#### Senior Consultant,

Division of Adult Cardiac Surgery,

Department of Cardiac, Thoracic and Vascular Surgery,

#### Clinical Director,

Department of Cardiac, Thoracic and Vascular Surgery,

National University Heart Centre, Singapore



#### **1** Why did you choose Cardiothoracic Surgery as your specialisation?

It was an easy choice for me. Even from as far back as my A-level Biology classes, I found the heart and circulation more interesting than any other organ system we studied. This was reinforced in medical school, when our first lectures were on the cell membrane action potential, and when I had my physiology tutorials in the same laboratory in which Hodgkin & Huxley conducted their experiments on cell membrane physiology. Cardiac physiology, embryology, and so on came naturally during the basic science years. The affinity (to surgery) was even more apparent during my clinical years, when I learnt more about heart diseases during my Cardiac Surgery posting than I did during my Cardiology posting. Other factors included the inspiration of my anatomy tutor in Cambridge University, the late DC Dunn who was a general surgeon, and my clear preference after my pre-registration

house officer jobs for a career in Surgery over one in Medicine. There were obvious challenges, such as the advice of more than one cardiothoracic surgeon to consider my options as I was “female, foreign, too short and looked too young”. I did explore other options during my basic surgical training, but at the end of the day, this was really the only one career I wanted.

#### **2** How would you describe your experience during your training in adult cardiac surgery and subsequently, working in the UK?

Training in adult cardiac surgery required hard work and persistence. After I completed my basic surgery training there was a moratorium on recruiting trainees into cardiothoracic training in the UK for a couple of years. I had to persevere in a service post (equivalent to our MOPEX MOs) waiting for a break, and even explored the possibilities of

training in another country. When the specialty started recruiting again, there were so many applicants that the ratio was 200 applicants to every 1 training post! The requirements for short-listing were high – just to make it to interview, we needed 2 years of post-BST experience in Cardiothoracic Surgery as well as a research degree – so I went to University College London for 3 years to do my research for my postgraduate thesis. My first supervisor was a cardiothoracic surgeon, and he interviewed me by asking me to assist him as first assistant in a CABG. I had not started formal training, nor met him prior to the interview, and clearly, had never seen how he operated. Despite the odds, I was offered a job after that, so I guess I did OK.

Once I got my break, being “female, foreign, too short and look(ing) too young” did not make any difference. At the time, there was only one female consultant

cardiac surgeon and one female thoracic surgeon in the UK (amongst over 100 consultants). By the time I finished my training, there were at least another 5 female consultant cardiothoracic surgeons, and quite a few more waiting to come through. Being female was not an issue, though one of my fellow trainees did encounter problems as a single mum trying to bring up two children. The specialty is very open-minded, and I would say that cardiac surgery is probably the most diverse of surgical specialties in the UK with regards to race and nationality.

My training in adult cardiac surgery was fairly comprehensive. Over the years, including my exposure before and after my Specialist Registrar training, I had the chance to learn from 23 different cardiac surgeons across 6 different hospitals. In retrospect, it was an incredible opportunity to watch and learn. I was even able to teach one of my trainers how to perform minimally-invasive heart valve surgery, having learned it from my previous trainer! The case volume was also higher than it is in Singapore, so there were much more opportunities to get hands on training comparatively. In spite of the high patient volume, the high number of trainees helped to ensure there was a better work-life balance.

The UK was my home for a long time – I went there since I was 14 years old, studied, grew-up and received training till consultant. Working there was a good experience. The work culture was good, the principle of the NHS (free healthcare at the point of delivery) was fair, and I was lucky to work in high performing hospitals that attracted good doctors, nurses, allied health and admin staff. Also, the British culture is rather different from the Singapore culture, thus patients' and relatives' engagement towards achieving a common goal in their health was rather different. On top of that, the UK, has a strong primary care physician system which supports the hospitals, reducing their workload. When I trained in the UK, it was a routine to discharge our CABG patients back to their primary care physicians 6 weeks after their operation if they do not encounter any post-operative complications.

### **3 How do you see the relevance of your specialty in the region?**

Heart disease is common, and the treatments continue to evolve. As a region, Asia suffers an under-provision of cardiac services, more in Cardiac Surgery than in Cardiology. Cardiologists and Cardiac surgeons have worked together for decades, and the working relationship between the two disciplines is becoming closer as patients become more complex and hybrid approaches to management become more commonplace. This close working relationship is central to how we work at the NUHCS, bringing to light the relevance of adult cardiac surgery's role in what our Heart Centre brings to the region. I believe our close collaboration (of Cardiac surgeons and Cardiologists) is unique, even in Singapore. The challenge is accessibility – both geographically, for patients around the region, and with regard to cost, for patients at home and abroad.

### **4 Could you tell us more about the innovative transcatheter therapy that you are involved in?**

I am involved in two transcatheter programmes. Both seek to use catheter-guided device implantation to reduce the morbidity and mortality associated with major open cardiovascular surgery.

One is the Transcatheter Aortic Valve Implantation (TAVI) program. This is a therapy used to treat patients with severe aortic stenosis, primarily to improve quality of life but with the added benefit of an improvement in prognosis as well. It has proven advantages over conventional surgery in patients who are either defined as high risk or too high risk for conventional surgery, with better outcomes. The jury is still out on whether or not it is a valid alternative in moderate risk patients; but it is definitely not suitable for low risk patients.

The other is the Thoracic Endovascular Aortic Aneurysm Repair (TEVAR) program. TEVAR is used to treat patients with thoracic aortic aneurysm or dissection. As our department's Clinical Lead for Aortic Surgery I work closely with our vascular surgeons on the hybrid approach

for treating patients with complex thoracic aortic disease which cannot be managed with a stent alone. This is also an evolving field dealing with high risk cases.

### **5 Do you have any tips to share with our primary care physicians in managing patients with heart problems, especially post-surgery?**

There is really nothing special about most adult cardiac surgery patients. People who have had previous heart surgery should be treated as any other patient. I always tell my patients to get back to their normal lives, and stress the importance of secondary prevention, especially for patients with coronary artery disease. CABG surgery is performed on 70-80% of our adult cardiac surgery patients. As such, if a primary care physician sees a patient who has had heart surgery, part of the checklist needs to include all aspects of secondary prevention for cardiovascular disease: blood pressure control, cholesterol, diabetes, smoking cessation, diet, exercise, and weight control.

The other consideration is for patients with implants such as prosthetic heart valves, there is always a risk of endocarditis. So, bacterial infections should be treated more seriously. One group of patients who may fall through the net and be lost to specialist follow-up is those with chronic aortic dissections. These patients are at risk of premature death due to their aortic disease, so they should be seen by a specialist – either a cardiac surgeon or a vascular surgeon.

### **6 Lastly, what did you miss the most from Singapore while you were away for training and work overseas?**

I missed my family - I was only 14 years old when I left Singapore to go and study in England. During that time, I grew-up, and my parents grew older. After so long overseas, it was important for me to be able to spend some time with them. I am grateful to Prof CN Lee, who was the Head of Department of CTVS at the time, for giving me the opportunity to come back and join the team here in NUH.

# UPCOMING EVENTS

## NUH GP CME Programme 2015

Please refer to our GPLC website for online registration.

### March

<b>SATURDAY</b> National University Heart Centre, Singapore NUHCS Cardiology Updates <b>All You Want to Know about Atrial Fibrillation</b>  Khoo Teck Puat – National University Children’s Medical Institute <b>Doctor’s Interactive Session on Food Allergy @ Regent Hotel, Royal Pavilion Ballroom, Lobby Level</b> Event starts at 11.15 am For registration: <a href="mailto:ican@nuhs.edu.sg">ican@nuhs.edu.sg</a> or 6772 4420	<b>7</b>	<b>SATURDAY</b> University Surgical Cluster Division of Colorectal Surgery <b>Partners in Colorectal Cancer – You and NUHS</b>	<b>21</b>
		<b>SATURDAY</b> University Orthopaedics, Hand and Reconstructive Microsurgery Cluster NUH Sports Centre <b>Management of Sport Related Conditions</b>	<b>28</b>

[www.nuhcme.com.sg](http://www.nuhcme.com.sg)

Event information listed is correct at time of print.

While every attempt will be made to ensure that all events will take place as scheduled, the organisers reserve the rights to make appropriate changes should the need arises.

Please refer to our events calendar at [www.nuh.com.sg/nuh\\_gplc](http://www.nuh.com.sg/nuh_gplc) for more updates and information.

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Advisor A/Prof Goh Lee Gan  
Editors Jaime Raniwaty Chiah and Davin Wangsa  
Editorial Member Lisa Ang

We will love to hear your feedback on Médico.  
Please direct all feedback to:  
The Editor, Médico  
GP Liaison Centre, National University Hospital  
1E Kent Ridge Road, NUHS Tower Block, Level 6, Singapore 119228  
Tel: 6772 5079 Fax: 6777 8065  
Email: [gp@nuhs.edu.sg](mailto:gp@nuhs.edu.sg) Website: [www.nuh.com.sg/nuh\\_gplc](http://www.nuh.com.sg/nuh_gplc)  
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