APR-JUN 17

www.singhealth.com.sg

# MEDICAL NEWS

A SingHealth Newsletter for Medical Practitioners MCI (P) 027/11/2016

## FOCUS: HEART



**SingHealth Duke-NUS Academic Medical Centre**

• Singapore General Hospital • KK Women's and Children's Hospital • Sengkang Health • National Cancer Centre Singapore • National Dental Centre of Singapore • National Heart Centre Singapore • National Neuroscience Institute • Singapore National Eye Centre • SingHealth Polyclinics • Bright Vision Hospital

Appointments: 6704 2222
Email: central.appt@nhcs.com.sg

# Transcatheter Aortic Valve Implantation (TAVI) – An Alternative Treatment for Symptomatic, Severe Aortic Stenosis Patients with High Surgical Risks

*Asst Prof Ho Kay Woon, Senior Consultant,*
*Department of Cardiology, National Heart Centre Singapore*

The prevalence of aortic stenosis (AS) is increasing with the ageing Singapore population. It is estimated that moderate or severe aortic stenosis exists in 3% of patients more than 75 years old and 8% in those more than 85 years old.

The most common cause of AS is degeneration of the native aortic valve in elderly patients. These patients often have multiple medical comorbidities and are at high risk for surgical aortic valve replacement, resulting in life-saving surgery being withheld. Less common causes of AS include rheumatic heart disease and bicuspid aortic valve.

The progress of AS is not altered with medical therapy. Once patients develop symptoms of severe aortic stenosis classically of chest pain, syncope and exertional dyspnoea, prognosis with medical therapy alone is grim with high mortality of 50% over 2 years.

**Transcatheter Aortic Valve Implantation (TAVI)** has emerged as an alternative treatment of severe symptomatic AS in patients who are not suitable for conventional surgical aortic valve replacement due to high surgical risks.

## TREATMENT OPTIONS FOR AORTIC STENOSIS

Medical treatment for severe AS does not alter the poor prognosis and is of marginal benefits. Balloon aortic valvuloplasty carries significant procedural risks and is generally associated with restenosis of the aortic valve within 6 months of treatment.

The only effective therapy for AS is aortic valve replacement, which restores life expectancy to age-matched population without AS. Surgical aortic valve replacement typically with a bioprosthetic valve in the elderly patient is the gold standard of treatment in low surgical risk patients.

Patients are considered at high risk for open heart surgery either due to medical comorbidities or specific surgical technical difficulties, for example prior chest radiation therapy, patent coronary artery bypass grafts, and the presence of heavily calcified ascending aorta.

In such high surgical risk patients, TAVI can be a life-saving treatment for AS. The first implantation was by Cribier in 2002 and since then, the TAVI technology has taken quantum leaps with improvement in design and deliverability, resulting in better clinical outcomes with reduction of complications.

These advancements have resulted in the proliferation of TAVI worldwide, benefitting numerous severe aortic patients without surgical options who would otherwise face recurrent heart failure hospitalisation and certain mortality within a few years.

## TRANSCATHETER AORTIC VALVE DEVICES AND IMPLANTATION PROCEDURE

At present, there are 2 established transcatheter aortic valve types for treatment of aortic stenosis:

1. The first is the **balloon-expandable stent valve** design epitomised by the SAPIEN transcatheter heart valve (THV) by Edwards Lifesciences. The Edwards SAPIEN THV consists of three bovine-pericardial tissue leaflets sewn and mounted on a balloon-expandable stent frame.

   The stent valve is crimped onto a balloon on a valve delivery system. This valve is designed to be implanted from the common femoral artery or from the left ventricular apex if the femoral arteries are unsuitable *(Figure 1)*. A support wire is positioned across the native aortic valve in the left ventricle.

   After initial balloon predilatation of the aortic valve *(Figure 2)*, the stent valve is positioned across the native aortic valve on a support wire *(Figure 3)*. The heart is then paced rapidly at typical rates of 180 per minute via a temporary pacing wiring placed in the right ventricle to reduce cardiac output, stabilising the THV position and allowing for accurate implantation of the THV by balloon inflation *(Figure 4)*.

2. The second valve type is **the self-expanding stent valve** typified by the Medtronic COREVALVE *(Figure 5)*. This valve design is implanted via the transfemoral, subclavian or direct aortic approaches.

   At the centre of the system is a self-expanding Nitinol stent frame which holds 3 bioprosthetic valve leaflets made from porcine pericardium. The Corevalve delivery system accommodates the bioprosthesis and is brought across the native aortic valve over a support wire. The delivery system is then slowly withdrawn to uncover and deploy the sheathed self-expanding stent across the native aortic valve.

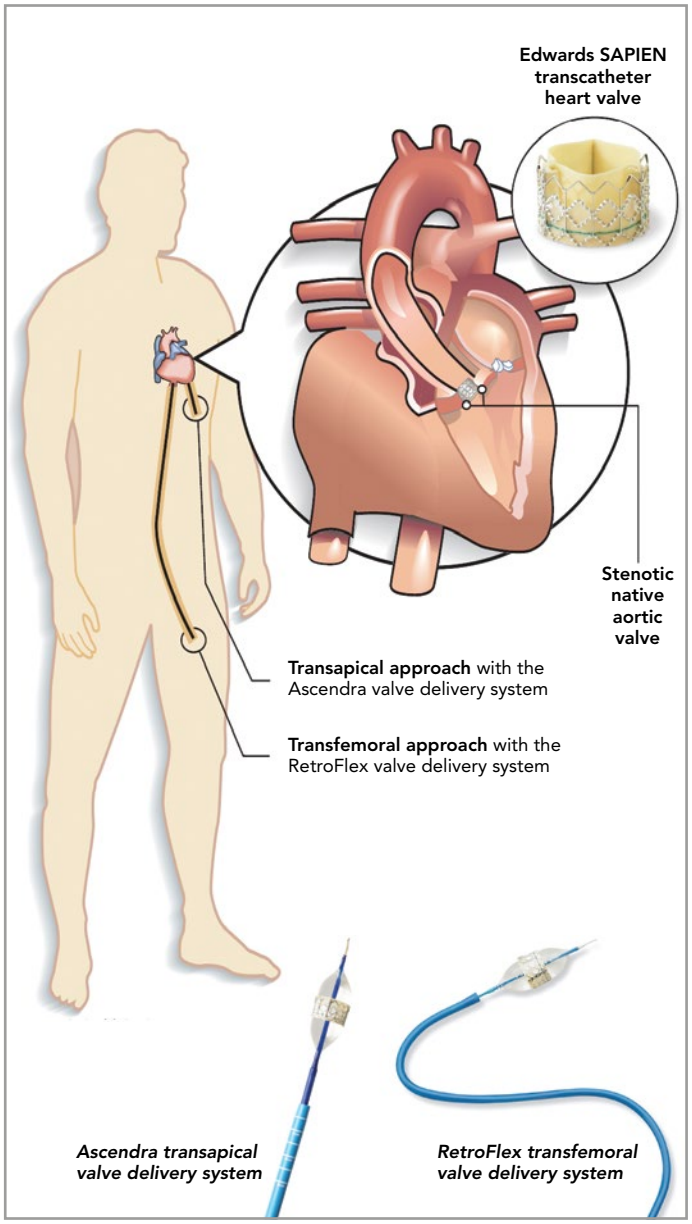



*Figure 1* Common vascular access sites for Transcatheter Aortic Valve Implantation (TAVI)

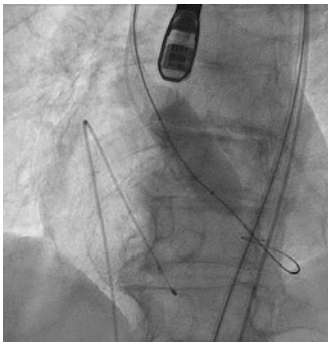


*Figure 2* Balloon predilatation

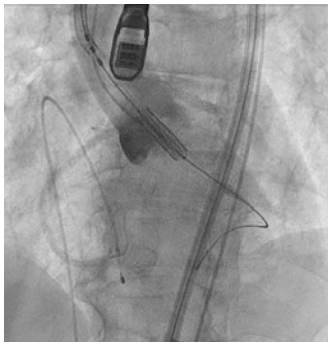


*Figure 3* TAVI positioning

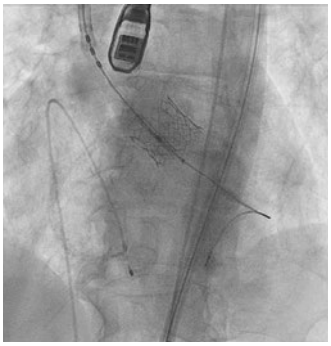


*Figure 4* TAVI valve deployed

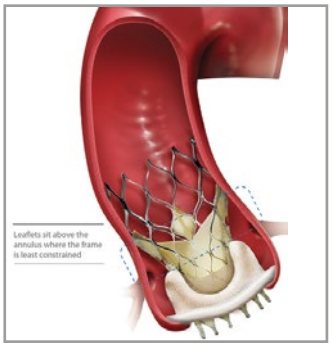


*Figure 5* Self-expanding Corevalve implantation

Appointments: 6704 2222
Email: central.appt@nhcs.com.sg

## VASCULAR ACCESS FOR TRANSCATHETER AORTIC VALVE IMPLANTATION

The Transcatheter Aortic Valve Devices are primarily designed for implantation percutaneously via the common femoral artery. Most devices require the insertion of an 18 French arterial sheath which mandates that the common femoral arteries have at least minimal lumen diameter of 6 to 7 mm without severe vessel calcification or severe tortuosity.

Improvements in design have reduced the size of the delivery system and the femoral artery size requirement to 5 mm, with the smallest profile TAVI devices allowing more patients to receive transfemoral TAVI therapy.

The adequacy of femoral artery vascular access is best evaluated with a CT scan which is done as part of pre-procedural evaluation. For patients with unsuitable femoral-iliac arterial access, alternative vascular access includes the transapical, direct aortic, subclavian approaches.

The transapical approach in which a 26 French vascular sheath is placed via the left ventricular a small left anterior thoracotomy at the fifth or sixth intercostal space. In contrast, direct aortic approach involves direct insertion of a vascular sheath into the ascending aorta via a small median sternotomy at the second intercostal space *(Figure 1)*.

The left subclavian artery of an adequate size can be used for subclavian approach when the patient's femoral-iliac arteries are of inadequate size. Regardless of the approach, once the vascular sheath is placed, a support wire can be placed across the native aortic valve for which to deliver the percutaneous valve to be implanted.

Once the percutaneous valve has been implanted, the vascular access can then be securely closed either by surgical repair or using pre-deployed percutaneous suture devices especially in the case of the transfemoral approach.

TAVI procedures can be done under general anaesthesia or local anaesthesia with sedation using the transfemoral approach. The TAVI procedure is generally completed within one hour and patient brought to the intensive care unit for observation overnight. The patient typically will be transferred to the general ward for ambulation the following day and will be discharged from hospital within a week.

## RESULTS

Large multicentre randomised controlled trials have established the benefits of TAVI in treatment of AS patients with prohibitive surgical risk and improvements of mortality and quality of life/symptoms compared to medical therapy.

Comparable results to surgical aortic valve replacement have also been found in high surgical risk AS patients treated with TAVI. Emerging trial data have suggested similar safety and efficacy of TAVI treatment of low- to moderate-risk AS patients.

**However, until strong evidence becomes available, TAVI will remain an alternative to the gold standard SAVR therapy of AS only in high-risk AS patients.**

## COMMON COMPLICATIONS

Common complications of TAVI trials include periprocedural death (3-4%), stroke (5%), vascular complications (10%) and high-grade AV block requiring pacemaker implantation (10-20%).

Leakage around the TAVI valve or paravalvular leak (PVL) causing aortic regurgitation can be caused by incomplete sealing of the aortic annulus by the TAVI valve from calcification, inaccurate positioning of the TAVI valve or improper sizing of the TAVI valve.

Significant PVL occurring post-TAVI can lead to increased morbidity from repeated heart failure hospitalisations and increased mortality, which emphasises the importance of pre-procedural planning, valve sizing and accurate placement of the TAVI valve.

## AT THE NATIONAL HEART CENTRE SINGAPORE

At the National Heart Centre Singapore (NHCS), TAVI has been performed in high-risk AS patients since 2009, with more than 200 patients treated.

These patients have high surgical risk with a mean society of thoracic surgeon (STS) score of 8.3% (> 8% being at high risk for surgery) or with surgical technical difficulties including porcelain aorta in 19.3%, patent bypass grafts in 19.3%, redo sternotomy in 12.1%; significant comorbidities including severe lung disease in 4.3%, chronic renal disease in 14.3% and advanced age/frailty in 19.3%.

TAVI was performed using the:

- Transfemoral approach in 75.7%
- Direct aortic approach in 3.6%
- Transapical approach in 20.7%

Procedural success was 91%.

Mean aortic valve pressure gradient at pre-TAVI was 46.7 mmHg and post-TAVI 18.2 mmHg during index hospitalisation, 12.0 mmHg at 1 month, 11.8 mmHg at 6 months and 10.9 mmHg at 1 year. Mean aortic valve area at pre-TAVI was 0.7 $cm^2$ and post-TAVI 1.6 $cm^2$ at 6 months and 1.6 $cm^2$ at 1 year.

Moderate to severe paravalvular leak post-TAVI was 11.4% during hospitalisation, 10.7% at 1 month, 5.7% at 6 months and 2.1% at 1 year. Mean New York Heart Association (NYHA) class was 2.7 pre-TAVI, 2.0 at 1 month, 1.8 at 6 months and 1.9 at 1 year post-TAVI.

30-day complication rates include:

- Mortality (8.6%)
- Pacemaker implantation (6.4%)
- Stroke (2.1%),
- Valve embolisation (2.1%)
- Major bleeding/vascular complications (12.1%)

This compares favourably with global data on TAVI procedures.

## CONCLUSION

The development of TAVI has made available a life-saving therapy for the otherwise inoperable severe AS patient. TAVI is a safe and efficacious alternative to surgical aortic valve replacement for treatment of high-risk, severe AS patients.

*Asst Prof Ho Kay Woon* is a Senior Consultant in National Heart Centre Singapore (NHCS). He sub-specialises in interventional cardiology with special interests in percutaneous coronary artery intervention, and percutaneous valvular therapy including transcatheter aortic valve implantation (TAVI).

Asst Prof Ho is also active in medical education. He is the Director of Medical Student Education in NHCS, with contributions to the teaching of medical students from Duke-NUS, Yong Loo Lin School of Medicine and Lee Kong Chian School of Medicine.

**GPs can call for appointments through the GP Appointment Hotline at 6704 2222, or scan the QR code for more information.**

Appointments: 6704 2222
Email: central.appt@nhcs.com.sg

# Cardiovascular Magnetic Resonance: Improving Cardiac Visualisation and Assessment

*Asst Prof Calvin Chin, Consultant,*
*Department of Cardiology, National Heart Centre Singapore*

Cardiovascular imaging assesses the structures and function of the heart non-invasively. Approximately 90 years ago, clinicians relied on chest x-ray as the main imaging tool to assess cardiac size and abnormalities based on cardiac shadows.

Today, more advanced imaging modalities have evolved, each with its unique strengths, limitations and preferred indications (*Table 1*).

The National Heart Centre Singapore (NHCS) has performed more than 2,200 cardiovascular magnetic resonance (CMR) scans in 2016, an increase of more than 500 cases from the year before.

CMR uses very powerful magnets and radio frequency pulses to create images within the cardiovascular system. It does not involve any ionising radiation and the risks of the test are very low.

**When would Cardiovascular Magnetic Resonance (CMR) be useful for my patients?**

- Newly-diagnosed heart failure
- Suspected ischaemic heart disease
- Suspected cardiomyopathies (left ventricular hypertrophy/dilated left ventricle)

**However, there are situations where a patient is not suitable for CMR:**

- **Patients with devices such as cardiac pacemakers, implantable cardioverter-defibrillators, cochlear implants, surgical clips or metal in the eye.** Metallic heart valves are not contraindications but they can cause significant artefacts that can affect visualisation and assessment.
- Gadolinium-based contrast may be given during the examination. **Women who are pregnant or breastfeeding, and individuals with renal impairment are not suitable for contrast-enhanced CMR**. Rarely, some individuals develop allergic reactions to the contrast.
- **Claustrophobia**

***Table 1*** **Strengths and Limitations of Common Cardiac Imaging Techniques**

| Imaging modality | Strengths | Limitations | Selected indications |
|---|---|---|---|
| **Echocardiography** | • No radiation<br>• Relatively low cost<br>• Fast procedure<br>• Widely available | • Image quality depends on patient selection and operator experience | • First-line assessment of cardiac function<br>• Valvular heart disease<br>• Ischaemic heart disease<br>• Congenital heart conditions |
| **Nuclear imaging** | • Assess myocardial blood flow and myocardial metabolism | • Exposure to radiation | • Ischaemic heart disease<br>• Assessment of cardiac function |
| **Computed tomography** | • Relative fast procedure | • Exposure to radiation | • Assessment of coronary artery disease<br>• Aortic diseases<br>• Congenital heart conditions |
| **Cardiac magnetic resonance imaging** | • No radiation exposure<br>• Accurate assessment of cardiac volumes and mass<br>• Myocardial tissue characterisation | • High cost<br>• Not widely available | • Heart failure<br>• Cardiomyopathies<br>• Ischaemic heart disease<br>• Aortic diseases<br>• Congenital heart conditions |

## ASSESSMENT OF CARDIAC VOLUMES AND LEFT VENTRICULAR MASS

Although echocardiography is widely-accepted as the first-line imaging in assessing cardiac function, they rely heavily upon suitable echocardiographic windows, experience of the operator and a series of geometric/mathematical assumptions in estimating left ventricular mass and cardiac volumes.

Moreover, the right ventricle is notoriously difficult to evaluate by echocardiography because of its crescentic geometry and high tendency of signal dropout.

CMR permits full coverage of the entire heart without the acoustic window limitations of echocardiography and geometric assumptions are not required for the calculations of cardiac volumes and mass. In addition, CMR is considered the standard for assessing the right ventricle. Higher spatial resolution and ability to segment the right ventricle from surrounding structures are inherent strengths of CMR over echocardiography and nuclear techniques.

Indeed, CMR is highly-reproducible in patients with either normal or abnormal cardiac morphology. This is important for serial assessment in patients to monitor progression of disease or response to therapies.

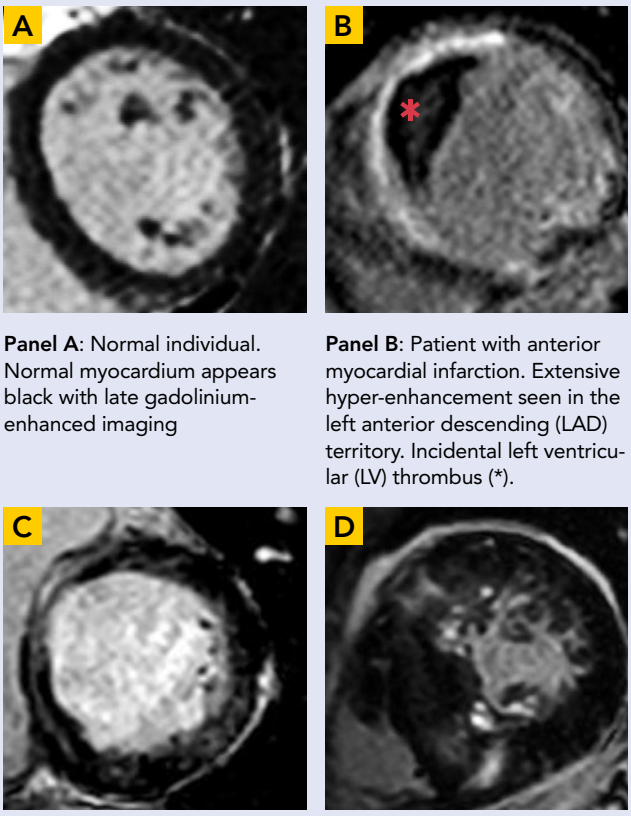
## MYOCARDIAL CHARACTERISATION

The use of gadolinium contrast in CMR has dramatically improved tissue characterisation of the myocardium, unparalleled in other non-invasive imaging modalities.

In many cardiac pathologies, the interstitium expands due to collagen deposition (myocardial fibrosis from myocardial infarction or non-ischaemic cardiomyopathies) or infiltrative processes (cardiac amyloid or sarcoid). Gadolinium contrast (an extracellular-based CMR contrast) accumulates in the diseased interstitium.

In combination with delayed washout of gadolinium over time, abnormal myocardial enhancement can be detected using late gadolinum-enhanced imaging techniques.

In the appropriate clinical setting, patterns of abnormalities are diagnostic of specific cardiac conditions *(Figure 1)*. Some of these conditions may otherwise require myocardial biopsies that are not only invasive, more costly but also prone to sampling errors.



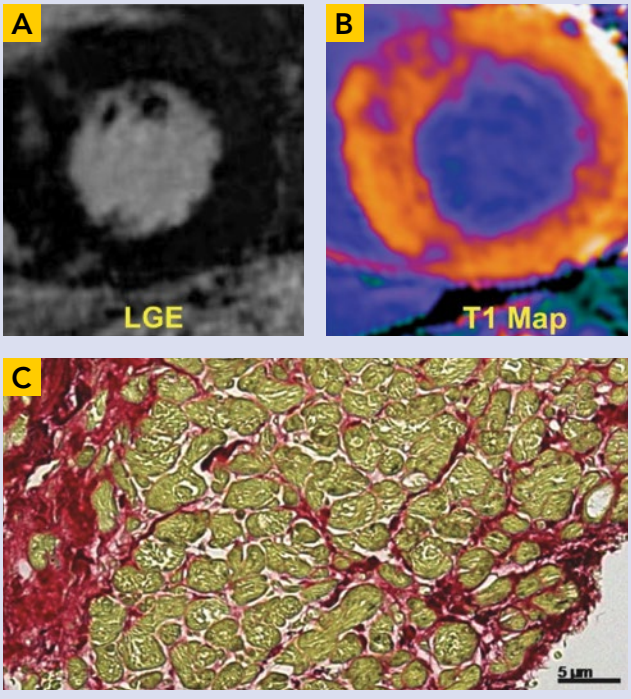

**Panel A**: Normal individual. Normal myocardium appears black with late gadolinium-enhanced imaging

**Panel B**: Patient with anterior myocardial infarction. Extensive hyper-enhancement seen in the left anterior descending (LAD) territory. Incidental left ventricular (LV) thrombus (*).

**Panel C**: Mid-wall fibrosis in the septum is commonly seen in patients with dilated cardiomyopathy

**Panel D**: Patient with hypertrophic cardiomyopathy. LV mass increased with thickened myocardium. Fibrosis commonly seen in the anterior and posterior right ventricular (RV) insertion points.

*Figure 1*




A patient with severe aortic stenosis. Non-ischaemic type myocardial fibrosis was detected on late gadolinium-enhanced **(Panel A)** imaging and myocardial T1 mapping **(Panel B)**, and these findings were confirmed on histology **(Panel C)**.

*Figure 2*

Myocardial fibrosis is associated with a worse prognosis in patients with myocardial infarction and cardiomyopathies such as dilated or hypertrophic cardiomyopathies.

Recently, we have shown that myocardial fibrosis can also occur in individuals such as aortic stenosis and hypertensive heart disease. Improved myocardial mapping techniques have been developed that increases diagnostic accuracy in detecting myocardial fibrosis *(Figure 2)*.

## STRESS CMR TECHNIQUES

Like many CMR centres, adenosine is used in our pharmacologic stress CMR protocols. Adenosine directly vasodilates coronary arteries and increases flow. In haemodynamically-significant coronary artery stenosis, flow is reduced and this flow heterogeneity can be detected using CMR perfusion imaging techniques.

Indeed, *adenosine perfusion stress CMR* has demonstrated high accuracy in diagnosing significant coronary stenosis in individuals who present with suspected coronary artery disease.

Exercise is the most physiological stress technique. Moreover, physiological parameters during exercise offer incremental prognostic value.


***Figure 3*** In-scanner supine cycle ergometer

*Exercise stress CMR* has been challenging due to limited availability of CMR-compatible exercise equipment and inadequate spatiotemporal resolution from conventional CMR imaging techniques.

**Recently, our Centre has optimised an exercise CMR protocol using an in-scanner supine cycle ergometer that allows assessment of cardiac capacity at every stage of exercise *(Figure 3)***. This protocol has been validated against the cardiopulmonary exercise test, the gold standard non-invasive test of assessing exercise capacity.

The clinical utility of this exercise protocol can differentiate individuals with athlete's heart physiology from early dilated cardiomyopathy. Although both conditions commonly present with increased cardiac volumes and/or mildly-impaired systolic function, they are managed very differently.

We are currently conducting a study to examine the role of this exercise CMR protocol in diagnosing significant coronary artery disease.

## FINAL THOUGHTS

CMR provides high-quality diagnostic information without exposing the patient to ionising radiation. It complements other imaging modalities in the diagnosis and management of many complex cardiovascular conditions.

With advances in CMR technology, expansion of clinical indications is expected in the near future.

*Asst Prof Calvin Chin* is a Consultant with the Department of Cardiology at the National Heart Centre Singapore (NHCS), and an Assistant Professor at the Duke-NUS Medical School. His research uses non-invasive imaging and biochemical markers to study myocardial hypertrophy and fibrosis in patients with acquired left ventricular hypertrophy (such as aortic stenosis and hypertensive heart disease).

He is accredited in echocardiography and cardiovascular magnetic resonance imaging.

**GPs can call for appointments through the GP Appointment Hotline at 6704 2222, or scan the QR code for more information.**

# Next Generation Cardiac Implantable Electronic Devices

*Adj Asst Prof Daniel Chong, Senior Consultant,*
*Department of Cardiology, National Heart Centre Singapore*

## EVOLUTION OF THE CARDIAC PACEMAKER

Cardiac pacemakers have been around since the 1960s. They have become a cornerstone of treatment for complete heart block and sick sinus syndrome.[1-2] Patients who used to have recurrent syncope or giddiness could now live normal lives. Indeed, many patients with complete heart block and sick sinus syndrome continue to work and lead very active lives after their pacemaker implantation.

Over the years, the size of the pacemaker has shrunk and the electronics within have increased in complexity and function, mirroring the advance in microelectronics. However, the overall form of the pacemaker has not changed significantly – till now.

Pacemakers traditionally consist of 2 major components – the pulse generator (which contains the battery and electronics) and the leads (insulated wires that connect the pulse generator to the heart). Many patients, however, find the pulse generator bulge unsightly and cardiologists have to manage the leads that malfunction.

## NEXT GENERATION OF PACEMAKERS

Recently, a new type of pacemaker has been developed[3-5] that is about the size of a large capsule placed directly in the heart – the leadless pacemaker. It can be implanted via a femoral vein puncture in about 30 minutes – half the time of the traditional pacemaker.

The leadless pacemaker no longer leaves a scar or unsightly bulge over the chest of patients as it is located fully within the right ventricle. It is also less prone to infection – minimising one of the most common complications of pacemaker implantation. National Heart Centre Singapore (NHCS) was the first in Singapore to begin implanting the leadless pacemaker in patients last August.

Currently the leadless pacemaker is most suitable for older patients who require only right ventricular pacing or in patients with bilateral occluded subclavian veins. As the technology matures, this new device will likely become the preferred option for more patients.

## VENTRICULAR FIBRILLATION AND SUDDEN CARDIAC ARREST

In the past, patients who developed ventricular fibrillation (VF) cardiac arrest would have to be very fortunate to survive. These patients would require:

1. A passer-by or family member to realise that they have collapsed
2. Cardiopulmonary resuscitation (CPR) to be started early (often within a few minutes of VF)
3. A defibrillator be placed early to detect patient's VF and defibrillation administered in a timely manner – the cardiac life support 'chain of survival'

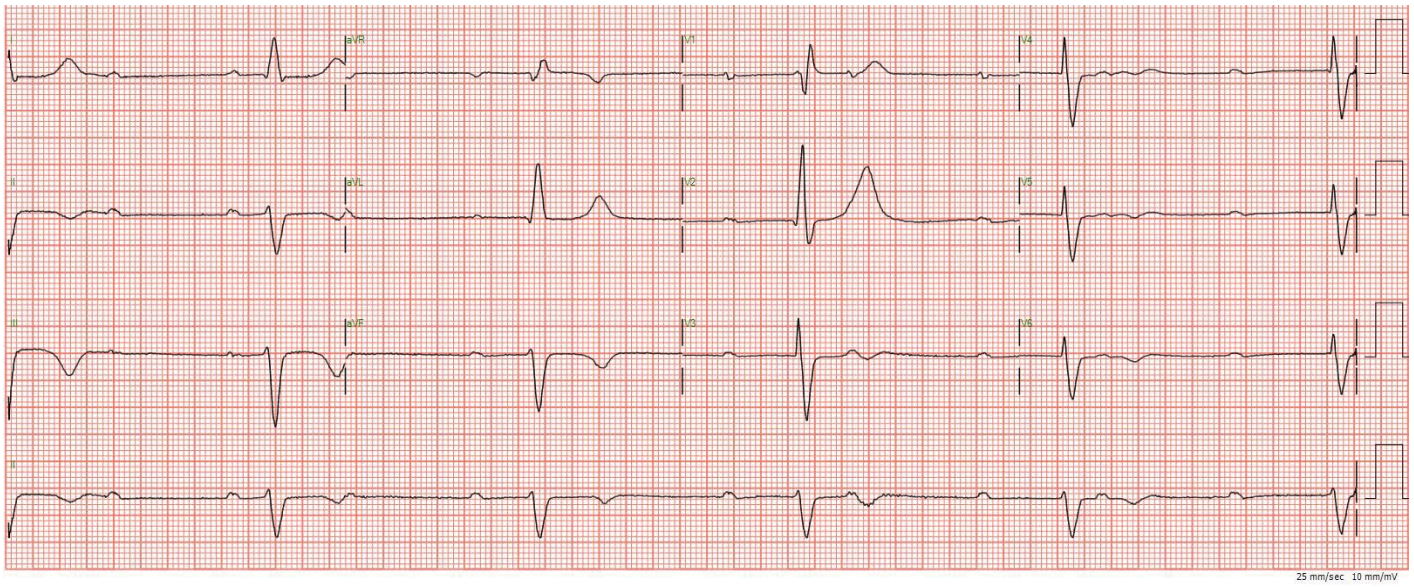



*Figure 1* Complete heart block on the ECG


*Figure 2* Comparison of the size of traditional and next generation pacemakers in relation to a capsule


*Figure 3* Size of the leadless pacemaker

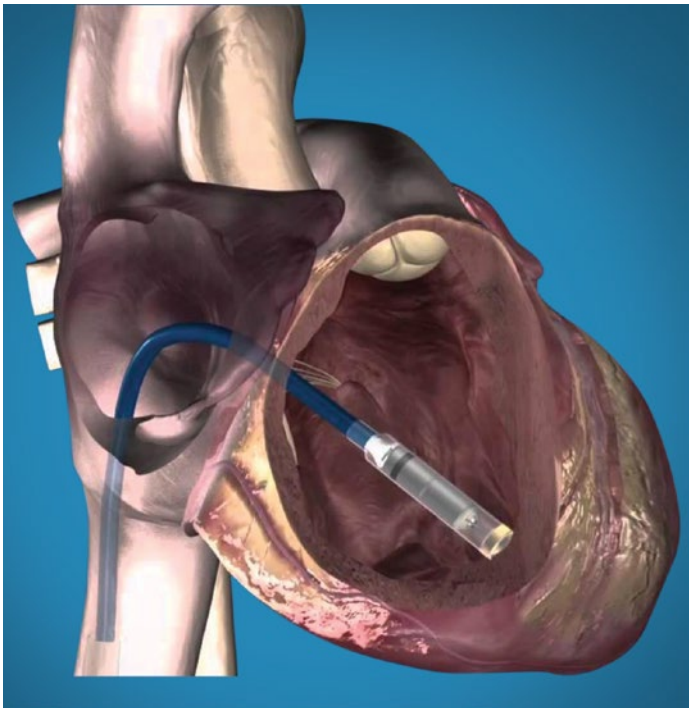


*Figure 4* Placement of the leadless pacemaker in the right ventricle using a long delivery sheath from the patient's femoral vein

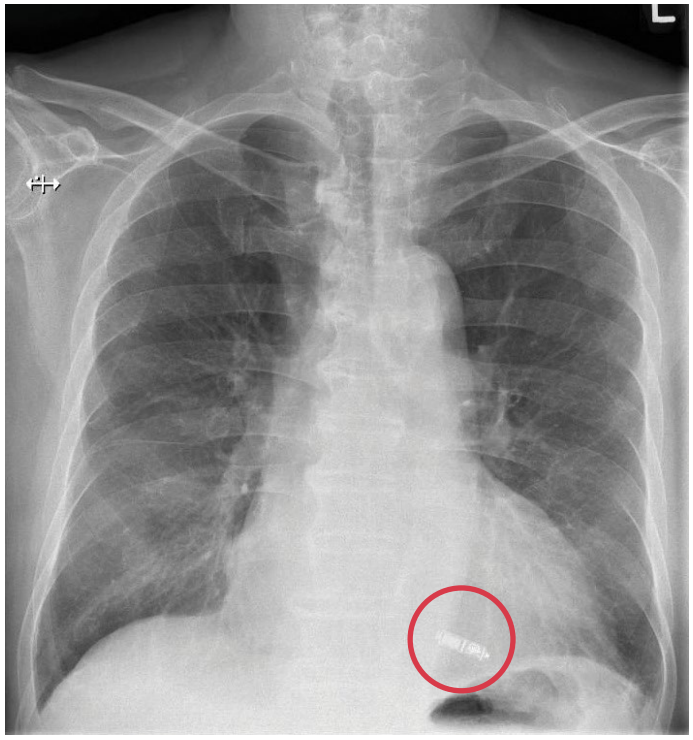


*Figure 5* Leadless pacemaker on Chest X-ray (CXR), near the cardiac apex

It is therefore not surprising that only 2% of sudden cardiac arrest patients in Singapore survive.[6] In recent years, attempts have been made to improve this figure by training more members of the public with CPR and having automated external defibrillators widely available.

**Implantable Cardioverter Defibrillator (ICD)**

Amongst patients already known to be at high-risk of VF however, there is a technology that has been proven to save lives[2] – the implantable cardioverter defibrillator (ICD).

This device is implanted in the same way as a traditional pacemaker, monitors a patient's heart rhythm all the time (24 hours, 7 days a week), detects VF and delivers a life-saving shock automatically. Some ICDs have a battery life of more than 10 years. Over the past decade, the number of patients undergoing ICD implantation has increased.[7]

**New Generation of ICD**

In the past few years, a new version of the ICD has been developed[8] that does not require placement of an intravascular lead – the entirely subcutaneous ICD.[9]

This new development reduces the risk of systemic infection and eliminates the need for central venous access. The entirely subcutaneous ICD can be implanted in most hospitals in Singapore, and has been performed at NHCS over the past 4 years.

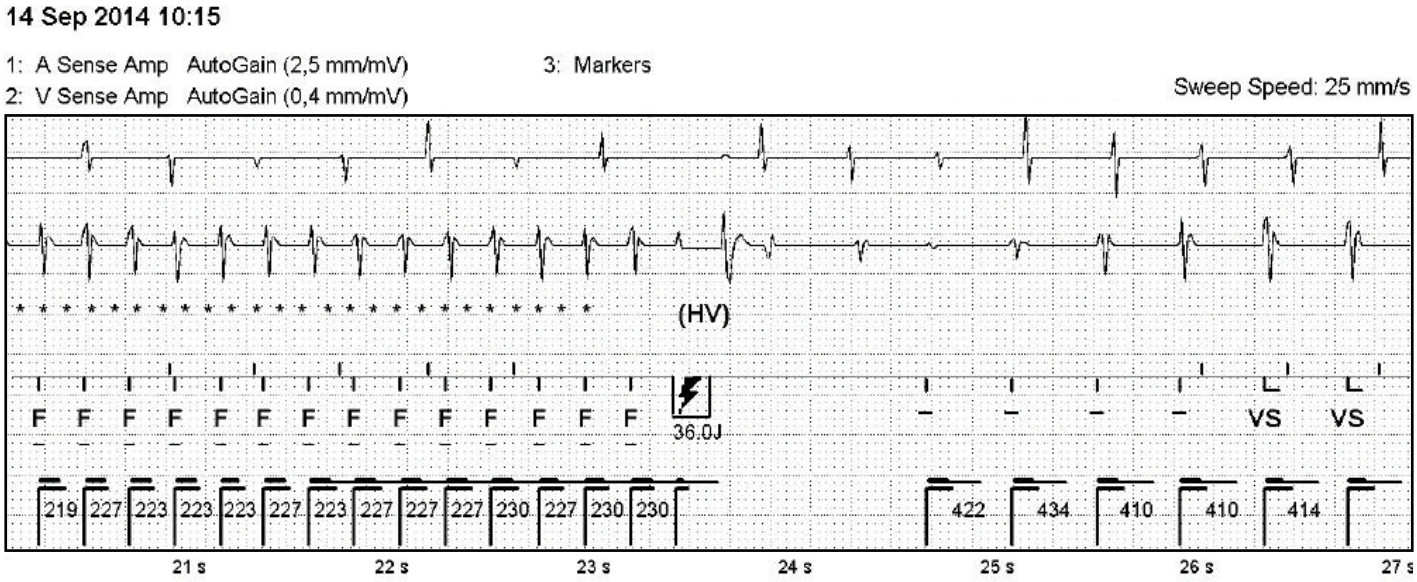



*Figure 6* Ventricular tachycardia successfully detected and defibrillated automatically by patient's ICD

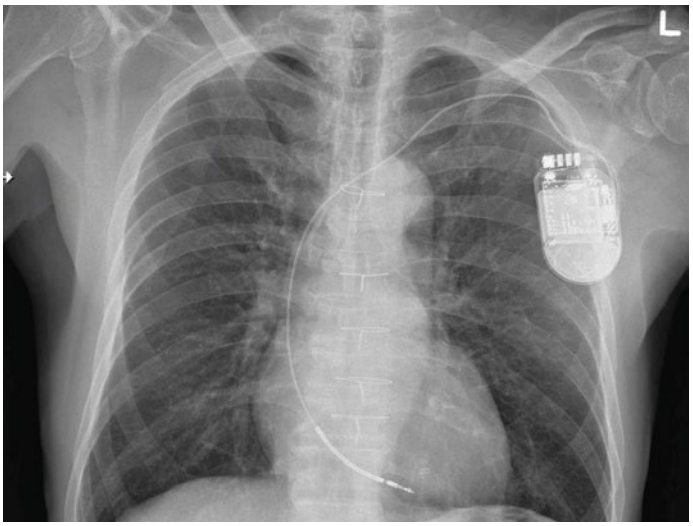



*Figure 7* Transvenous implantable cardioverter defibrillator on CXR

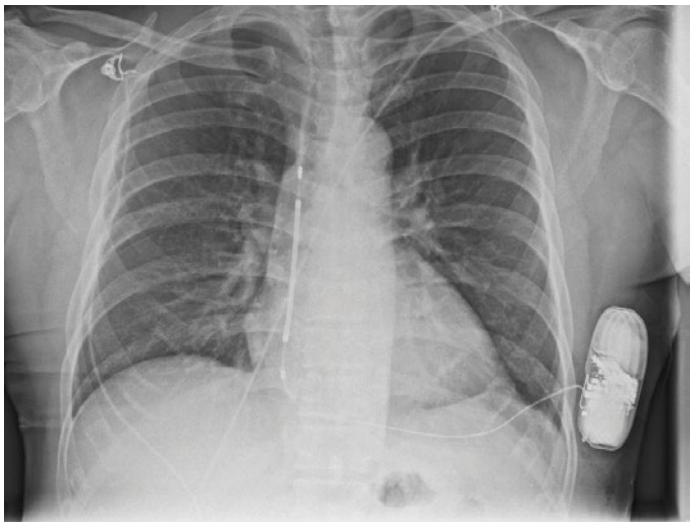


*Figure 8* Entirely subcutaneous implantable cardioverter defibrillator on CXR

## CASE STUDY

*[Note: Minor changes to details have been made to ensure patient confidentiality.]*

Mr RHL is a 60-year-old store manager with hypertension, hyperlipidaemia and diabetes mellitus for the past 6 years. He saw his GP for recurrent lower limb swelling and shortness of breath. In view of his recurrent symptoms, he was referred to a cardiologist.

An echocardiogram was performed which showed a reduced left ventricular ejection fraction (LVEF) of 25%. Coronary angiogram showed only minor coronary artery disease – insufficient to account for his poor heart function.

RHL was eventually diagnosed with non-ischaemic cardiomyopathy after a complete work-up. When his LVEF did not improve after a year on medical therapy, he agreed to an ICD implant.

Three months after his implant, he woke up in the middle of the night after some chest discomfort, but did not think much about the event. He returned to work the next morning. It was only at his subsequent device check clinic visit that he realised he had received the life-saving therapy for ventricular tachycardia. His medications were optimised further and he remains on follow up with his GP and cardiologist.

## CONCLUSION

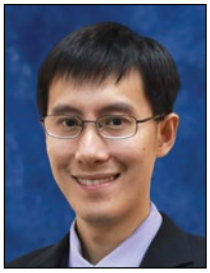
There have been rapid advances in electronic technology that has resulted in a new generation of pacemakers and implantable defibrillators. The appropriate use of these technologies has the potential to save many patients' lives.

**Primary care doctors can help by being aware of the increasing number of patients on these cardiac implantable electronic devices. GPs also have a critical role to play in referring appropriate patients for further cardiac assessment and management.**

## REFERENCES

1. European Society of Cardiology (ESC).; European Heart Rhythm Association (EHRA)., et al. 2013 ESC guidelines on cardiac pacing and cardiac resynchronization therapy: the task force on cardiac pacing and resynchronization therapy of the European Society of Cardiology (ESC). Developed in collaboration with the European Heart Rhythm Association (EHRA). Europace. 2013 Aug;15(8):1070-118. doi: 10.1093/europace/eut206.
2. Epstein AE, et al; American College of Cardiology Foundation.; American Heart Association Task Force on Practice Guidelines.; Heart Rhythm Society. 2012 ACCF/AHA/HRS focused update incorporated into the ACCF/AHA/HRS 2008 guidelines for device-based therapy of cardiac rhythm abnormalities: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines and the Heart Rhythm Society. J Am Coll Cardiol. 2013 Jan 22;61(3):e6-75. doi: 10.1016/j.jacc.2012.11.007.
3. Reynolds D, et al; Micra Transcatheter Pacing Study Group. A Leadless Intracardiac Transcatheter Pacing System. N Engl J Med. 2016 Feb 11;374(6):533-41. doi: 10.1056/NEJMoa1511643.
4. Reddy VY, et al; LEADLESS II Study Investigators. Percutaneous Implantation of an Entirely Intracardiac Leadless Pacemaker. N Engl J Med. 2015 Sep 17;373(12):1125-35. doi: 10.1056/NEJMoa1507192.
5. Wiles BM, Roberts PR. Lead or be led: an update on leadless cardiac devices for general physicians. Clin Med (Lond). 2017 Feb;17(1):33-36. doi:10.7861/clinmedicine.17-1-33.
6. Eng Hock Ong M, Chan YH, Anantharaman V, Lau ST, Lim SH, Seldrup J. Cardiac arrest and resuscitation epidemiology in Singapore (CARE I study). Prehosp Emerg Care. 2003 Oct-Dec;7(4):427-33.
7. Chong DT, Tan BY, Ho KL, Teo WS, Ching CK. Trends amongst implantable cardioverter defibrillator patients in a tertiary cardiac centre in Singapore from 2002 to 2011. Ann Acad Med Singapore. 2013 Sep;42(9):480-2.
8. Bardy GH, et al. An entirely subcutaneous implantable cardioverter-defibrillator. N Engl J Med. 2010 Jul 1;363(1):36-44. doi: 10.1056/NEJMoa0909545.
9. Hai JJ, Lim ET, Chan CP, Chan YS, Chan KK, Chong D, Ho KL, Tan BY, Teo WS, Ching CK, Tse HF. First clinical experience of the safety and feasibility of total subcutaneous implantable defibrillator in an Asian population. Europace 2015 Oct;17 Suppl 2:ii63-8.

** Images on page 9 and 10 courtesy of Medtronic Inc.*



*Adj Asst Prof Daniel Chong* is a Senior Consultant with the Department of Cardiology at the National Heart Centre Singapore (NHCS). He is also Deputy Director, Residency Programme in the Cardiovascular Sciences Academic Clinical Programme. His subspecialty interest is in electrophysiology and pacing.

**GPs can call for appointments through the GP Appointment Hotline at 6704 2222, or scan the QR code for more information.**

# Ovarian Tissue Transplant – Your Questions Answered

*Assoc Prof Yu Su Ling, Senior Consultant, Department of Obstetrics & Gynaecology; Director, Centre for Assisted Reproduction, Singapore General Hospital*

## WHEN DOES A PATIENT REQUIRE AN OVARIAN TISSUE TRANSPLANT?

The ovaries are vital to normal female reproductive function and fertility because they contain the female egg cells (oocytes) and secrete the female reproductive hormones.

Cancer treatment – in particular chemotherapy and radiotherapy – often destroys oocytes and ovarian function, and the woman's chances of bearing children permanently.

Ovarian tissue freezing (cryopreservation) and transplantation offers an opportunity for reproductive-aged women to preserve their fertility while undergoing cancer treatment.

## OVARIAN TISSUE TRANSPLANT ELIGIBILITY AND PREPARATION

There are several options for fertility preservation e.g. ovarian tissue freezing and transplant, oocyte (egg) storage for in-vitro fertilisation (IVF) later, as well as embryo storage. Therefore, thorough counselling by our fertility specialists is crucial.

**The patient is assessed by our transplant team at the Centre for Assisted Reproduction (CARE), Singapore General Hospital (SGH) to determine her suitability for ovarian tissue retrieval and freezing. She should be:**

- **Pre-menopausal at most 40 years old with early-stage cancer that does not involve her ovaries, and**
- **Should not have an increased risk of developing ovarian cancer (e.g carriers of the BRCA gene).**

The patient's ovarian tissue is harvested via an operation which can usually be performed through a 'key-hole' incision. The operation lasts for one hour and requires general anaesthesia.

For optimal results, it should be performed before the patient starts her cancer treatment. Should she require surgical treatment for her cancer, the two operations may be scheduled at the same time if feasible.

## OVARIAN TISSUE TRANSPLANT PROCEDURE

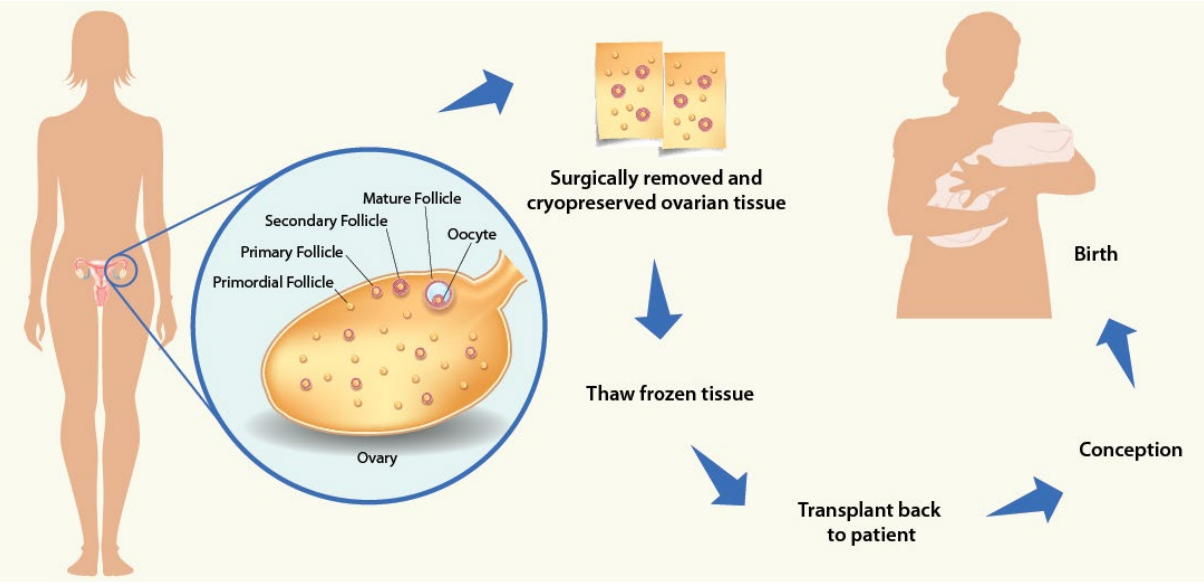
After the ovarian tissue is harvested, it is prepared for storage by our laboratory staff using specialised freezing techniques (cryopreservation).

The stored ovarian tissue is thawed and transplanted back into the body via a second operation. Given the limited lifespan of ovarian tissue grafts, transplantation should be postponed until the patient is ready to conceive or experiences symptoms of ovarian hormone deficiency.

The patient should also have:

- Completed her cancer treatment,
- Be in remission from her disease, and
- Undergone full assessment by her cancer specialist and our transplant team.

If needed, she may also be referred to an obstetric specialist to discuss about potential pregnancy complications unique to cancer survivors.



## TYPES OF OVARIAN TISSUE TRANSPLANT

There are two methods of ovarian tissue transplantation:

- **Orthotopic ovarian tissue transplantation** involves grafting of ovarian tissue back to its natural location in the body with the aim of allowing natural pregnancy to occur. It is currently the most effective technique for transplantation and has resulted in a series of live births.

- **Heterotopic ovarian tissue transplantation** involves grafting of ovarian tissue to another site in the body which allows easy access to the egg cells, most commonly underneath the skin of the forearm or the abdomen. As heterotopic transplantation avoids major abdominal surgery, this approach is beneficial for patients in whom repeat abdominal surgery may be complicated.

  However, the main disadvantage of this technique is that it would not allow natural pregnancy and in-vitro fertilisation would be needed for conception ('test-tube baby').

  In addition, while live births from experimental heterotopic transplants performed in primates have been reported, one human birth has been reported to-date.

In our Centre, orthotopic ovarian tissue transplantation is performed whenever feasible because of the uncertain effectiveness of heterotopic ovarian tissue transplantation in restoring fertility in humans.

## LIFE AFTER AN OVARIAN TISSUE TRANSPLANTATION

Unlike in conventional organ transplants, patients do not need to take any long-term immunosuppressive medications after ovarian tissue transplant surgery. This is because the ovarian tissue that is harvested and re-implanted back to the body is the patient's own, so there is no risk of organ rejection.

The lifespan of the graft is very variable and depends on the amount of tissue transplanted and the age of the female when the ovarian tissue was first removed. Graft survival ranging from a few months to up to ten years has been reported. It is currently not possible to predict how long the graft will function after transplant.

In general, the patient can expect to resume normal menstrual cycles within 4-9 months after transplantation. Among women who were trying to conceive after ovarian tissue transplant, a spontaneous pregnancy rate of about 30% has been reported.

## FREQUENTLY ASKED QUESTIONS

### What are the benefits of ovarian tissue freezing and transplantation compared to the other methods of fertility preservation (e.g. egg storage, embryo storage)?

Ovarian tissue freezing represents a more efficient way of preserving thousands of oocytes at one time, without the need for hormonal stimulation and a source of sperm. Therefore it is an ideal option for patients who lack a male partner and require cancer treatment urgently.

In contrast, egg and embryo freezing require a period of hormonal stimulation and only allow small numbers of eggs and embryos respectively to be preserved with each treatment cycle.

### I have completed my family but am worried about premature menopause after completing chemotherapy. Would ovarian tissue freezing and transplant be suitable for me?

Because of the limited duration of graft function, ovarian tissue transplant is unlikely to be effective for preserving the long-term hormonal function of the ovary. Currently it should only be performed with the aim of preserving fertility.

It is not recommended as a strategy for long-term hormone replacement and should not be performed to prevent premature menopause in women who do not wish to conceive after cancer treatment.

### Are there any risks involved with ovarian tissue transplantation?

There are surgical risks involved as two operations are needed to retrieve the ovarian tissue and graft the cryopreserved tissue back into the body.

It is not possible to test the retrieved ovarian tissue for tumour cells because the testing process will invariably destroy the ovarian tissue. There are theoretical concerns that there may be hidden tumour cells in the ovarian tissue which can be reseeded back into the body with the transplant. Therefore, careful patient selection is needed and we restrict the procedure to cancer patients with a low risk of ovarian involvement.

To-date, we have not encountered any reports of cancer recurrence resulting from reseeding of cancer cells from an ovarian tissue transplant.

As ovarian tissue transplant is a relatively new procedure, there has yet to be a published report of the short- and long-term outcomes of the children conceived by this method.

## HISTORY AND SUMMARY OF THE OVARIAN TISSUE TRANSPLANT PROGRAMME

| | |
|---|---|
| 1999 | First ovarian transplant of cryopreserved ovarian tissue performed in the United States |
| 2004 | First successful live birth after ovarian tissue transplant reported in Belgium |
| 2010 | First ovarian tissue cryopreservation operation done at SGH |
| 2012 | First ovarian tissue transplant operation done at SGH |

### OUR SPECIALISTS

Assoc Prof Yu Su Ling
Assoc Prof Yong Tze Tein
Dr Hemashree Rajesh

### CONTACT US

**Centre for Assisted Reproduction**
Block 5, Level 1
Singapore General Hospital
Tel: 6321 4292

*Assoc Prof Yu Su Ling* is a Senior Consultant with the Department of Obstetrics & Gynaecology, Singapore General Hospital (SGH).

Assoc Prof Yu is an accredited IVF specialist, Director of Centre for Assisted Reproduction. She sees patients with general gynaecology and obstetrics problems, and her special interests are in subfertility, menopause, and endoscopic surgery.

**GPs can call for appointments at the Centre for Assisted Reproduction at 6321 4292, or scan the QR code for more information.**

# SINGAPORE GENERAL HOSPITAL

Appointments: 6321 4402
Email: appointments@sgh.com.sg

## APPOINTMENT

**Dr Tan Tian Hui Jeremy**
*Senior Consultant*
**Dept**
Upper Gastrointestinal & Bariatric Surgery
**Sub-specialty**
Gastrointestinal, Laparoscopic & General Surgery, Surgical Oncology, Metabolic & Bariatric Surgery, Endoscopy

## PROMOTIONS - SENIOR CONSULTANTS

**Dr Harikrishnan Kothandan**
*Senior Consultant*
**Dept**
Anaesthesiology
**Sub-specialty**
Cardiothoracic Anaesthesia

**Dr Mok Un Sam**
*Senior Consultant*
**Dept**
Anaesthesiology
**Sub-specialty**
Obstetric Anaesthesia

**Dr Lee Haur Yueh**
*Senior Consultant*
**Dept**
Dermatology

**Dr Sathish Kumar Gopalakrishnan**
*Senior Consultant*
**Dept**
Haematology
**Sub-specialty**
Multiple Myeloma and Transplantation

**Dr Vijayendra Ranjan Baral**
*Senior Consultant*
**Dept**
Neonatal & Developmental Medicine

**Dr Darren Tay Keng Jin**
*Senior Consultant*
**Dept**
Orthopaedic Surgery
**Sub-specialty**
Adult Reconstruction Service

**Dr Jason Choo Chon Jun**
*Senior Consultant*
**Dept**
Renal Medicine
**Sub-specialty**
Chronic Kidney Disease, Glomerulonephritis and Renal Vasculitis

**Dr Tan Chieh Suai**
*Senior Consultant*
**Dept**
Renal Medicine
**Sub-specialty**
General Nephrology and Interventional Nephrology

**Dr Nor Azhari Bin Mohd Zam**
*Senior Consultant*
**Dept**
Urology
**Sub-specialty**
Endourology and Urinary Stone Disease, Benign Prostate Hyperplasia, Laparoscopic Surgery

**Dr Chng Siew Ping**
*Senior Consultant*
**Dept**
Vascular Surgery
**Sub-specialty**
Vascular and Endovascular Surgery

**Dr John Wang Chaw Chian**
*Senior Consultant*
**Dept**
Vascular Surgery
**Sub-specialty**
Vascular and Endovascular Surgery

# SINGAPORE GENERAL HOSPITAL

Appointments: 6321 4402
Email: appointments@sgh.com.sg

## PROMOTIONS - CONSULTANTS

**Dr Leow Wei Qiang**
*Consultant*
**Dept**
Anatomical Pathology
**Sub-specialty**
Histopathology, Cytology

**Dr Tan Yongcheng Benjamin**
*Consultant*
**Dept**
Anatomical Pathology
**Sub-specialty**
Histopathology, Cytology

**Dr Foo Fung Joon**
*Consultant*
**Dept**
Colorectal Surgery

**Dr Oh Choon Chiat**
*Consultant*
**Dept**
Dermatology

**Dr Chin Yung Ka**
*Consultant*
**Dept**
Gastroenterology & Hepatology

**Dr Shim Hang Hock**
*Consultant*
**Dept**
Gastroenterology & Hepatology

**Dr Tan Chuen Wen**
*Consultant*
**Dept**
Haematology

**Dr Tong Kian Ti Aaron**
*Consultant*
**Dept**
Nuclear Medicine & PET

**Dr Koo Oon Thien Kevin**
*Consultant*
**Dept**
Orthopaedic Surgery
**Sub-specialty**
Foot & Ankle Service

**Dr Tan Tze Sheng Edwin**
*Consultant*
**Dept**
Orthopaedic Surgery
**Sub-specialty**
Adult Reconstruction Service

**Dr Siti Radhziah Binte Sudirman**
*Consultant*
**Dept**
Otolaryngology

**Dr Saw Hay Mar**
*Consultant*
**Dept**
Rehabilitation Medicine

**Dr Htay Htay**
*Consultant*
**Dept**
Renal Medicine
**sub-specialty**
General Nephrology and Peritoneal Dialysis

**Dr Shaik Dawood Ubaidullah**
*Consultant*
**Dept**
Renal Medicine

**Dr Tan Ru Yu**
*Consultant*
**Dept**
Renal Medicine

**Dr Tan Gan Liang**
*Consultant*
**Dept**
Respiratory & Critical Care Medicine
**Sub-specialty**
Pulmonary Medicine

**Dr Gan Huei Li Valerie**
*Consultant*
**Dept**
Urology
**Sub-specialty**
Renal Transplant

**Dr Law Hui Nee Annie**
*Consultant*
**Dept**
Rheumatology & Immunology
**Sub-specialty**
General Rheumatology & Systemic Lupus Erythematosus

## SINGAPORE GENERAL HOSPITAL

Appointments: 6321 4402
Email: appointments@sgh.com.sg

### PROMOTIONS - CONSULTANTS

**Dr Sim Soon Phang Allen**
*Consultant*
**Dept**
Urology
**Sub-specialty**
Endourology, Laparoscopic and Robotic Surgery, Urinary Stone Diseases

**Dr Tay Kae Jack**
*Consultant*
**Dept**
Urology
**Sub-specialty**
Laparoscopic Surgery, Uro-oncology & Robotic Surgery

## KK WOMEN'S AND CHILDREN'S HOSPITAL

Appointments: 6294 4050
Email: centralappt@kkh.com.sg

### APPOINTMENTS

**Dr Pratibha Keshav Agarwal**
*Senior Consultant*
**Dept**
Child Development

**Dr Mahesh Nataraj Sangrithi**
*Consultant*
**Dept**
Reproductive Medicine

**Dr Yeo Tong Hong**
*Consultant*
**Dept**
Paediatrics (Neurology Service)

**Dr Chan Ching Yee**
*Associate Consultant*
**Dept**
Otolaryngology

**Dr Khoo Zi Xean**
*Associate Consultant*
**Dept**
Paediatrics (General Paediatrics & Adolescent Service)

**Dr Tan Yi Hua**
*Associate Consultant*
**Dept**
Paediatrics (Respiratory Medicine Service)

**Dr Roselyne Shirley Pat Fong**
*Associate Consultant*
**Dept**
Psychological Medicine

**Dr Kazila Bhutia**
*Associate Consultant*
**Dept**
Urogynaecology

### PROMOTIONS

**Dr Chin Hui Xian Felicia**
*Associate Consultant*
**Dept**
Gynaecological Oncology

**Dr Sim Wen Shan**
*Associate Consultant*
**Dept**
Maternal Fetal Medicine

**Dr Goh Si Hui**
*Associate Consultant*
**Dept**
Paediatrics (Allergy Service)

# KK WOMEN'S AND CHILDREN'S HOSPITAL

Appointments: 6294 4050
Email: centralappt@kkh.com.sg

## PROMOTIONS

**Dr Esther Leow Hui Min**
*Associate Consultant*
**Dept**
Paediatrics
(General Paediatrics & Adolescent Service)

**Dr Irene Teo Ai Ngee**
*Associate Consultant*
**Dept**
Paediatrics
(General Paediatrics & Adolescent Service)

## NEW APPOINTMENTS

**Dr Chua Mei Chien**
*Head*
**Dept**
Neonatology

**Dr Khoo Poh Choo**
*Deputy Head*
**Dept**
Neonatology

**Dr Gale Lim Jue Shuang**
*Head*
**Dept**
Plastic, Reconstructive & Aesthetic Surgery

**Adj Assoc Prof Tan Heng Hao**
*Director*
IVF Centre

**Dr Clement Kam Man Ho**
*Head*
Clinical Chemistry Service

**Dr Lam Ching Mei Joyce**
*Head*
Haematology Laboratory and Blood Bank

**Assoc Prof Tee Wen Sim Nancy**
*Head*
Microbiology Service

# SENGKANG HEALTH

Appointments: 6472 2000
Email: ah.appointment@skh.com.sg

## APPOINTMENTS

**Dr Chuo Mee Leh Adeline**
*Senior Consultant*
**Dept**
General Medicine
(Geriatric Medicine)

**Dr Tang Ong Teng**
*Senior Consultant*
**Dept**
General Medicine
(Internal Medicine)

**Dr Simon Stacey**
*Consultant*
**Dept**
General Medicine
(Geriatric Medicine)

## SENGKANG HEALTH

Appointments: 6472 2000
Email: ah.appointment@skh.com.sg

### APPOINTMENTS

**Dr Lee Wai Ching**
*Associate Consultant*
**Dept**
General Medicine (Internal Medicine)

**Dr Moy Wai Lun**
*Associate Consultant*
**Dept**
General Medicine (Internal Medicine)

**Dr Arellano Atienza Sergio**
*Associate Consultant*
**Dept**
Emergency Medicine

**Dr Mok Wing Yan**
*Associate Consultant*
**Dept**
Radiology

**Dr Sharmini Su A Sivarajah**
*Associate Consultant*
**Dept**
Surgery

### PROMOTIONS

**Dr Chew Min Hoe**
*Head and Senior Consultant*
**Dept**
Surgery

**Dr Baikunje Shashidhar**
*Senior Consultant*
**Dept**
General Medicine (Internal Medicine & Renal Medicine)

**Dr Chiam Pei Sze Priscilla**
*Consultant*
**Dept**
General Medicine (Endocrinology)

**Dr Mak May San**
*Consultant*
**Dept**
Radiology

**Dr Uppaluri Srinivas Anandswaroop**
*Consultant*
**Dept**
Radiology

## SINGAPORE NATIONAL EYE CENTRE

Appointments: 6322 9399
Email: appointments@snec.com.sg

### PROMOTIONS

**Dr Morgan Yang**
*Senior Consultant*
**Dept**
Oculoplastic

**Dr Jay Siak**
*Consultant*
**Dept**
Ocular Inflammation & Immunology

**Dr Deborah Tan**
*Consultant*
**Dept**
Paediatric Ophthalmology & Adult Strabismus

**Dr Tay Su Ann**
*Consultant*
**Dept**
Paediatric Ophthalmology & Adult Strabismus

**Dr Danny Cheung**
*Associate Consultant*
**Dept**
Surgical Retina

# NATIONAL HEART CENTRE SINGAPORE

Appointments: 6704 2222
Email: central.appt@nhcs.com.sg

## PROMOTION - SENIOR CONSULTANT

**Dr Chong Thuan Tee Daniel**
*Senior Consultant*
**Dept**
Cardiology
**Sub-specialty**
Electrophysiology and Pacing

## NEW APPOINTMENT

**Adj Assoc Prof Sahlen Anders Olof**
*Senior Consultant*
**Dept**
Cardiology
**Sub-specialty**
Echocardiography

## PROMOTIONS - CONSULTANTS

**Dr Laura Chan Lihua**
*Consultant*
**Dept**
Cardiology
**Sub-specialty**
Heart Failure

**Dr Chua Chi Ming Kelvin**
*Consultant*
**Dept**
Cardiology
**Sub-specialty**
Electrophysiology and Pacing

**Dr Go Yun Yun**
*Consultant*
**Dept**
Cardiology
**Sub-specialty**
Echocardiography and Cardiac Magnetic Resonance Imaging

## PROMOTIONS - ASSOCIATE CONSULTANTS

**Dr Ho Jien Sze**
*Associate Consultant*
**Dept**
Cardiology

**Dr Foo Jie Sheng**
*Associate Consultant*
**Dept**
Cardiology

**Dr Loh Xingyuan Julian Kenrick**
*Associate Consultant*
**Dept**
Cardiology

**Dr Mohammed Rizwan Amanullah**
*Associate Consultant*
**Dept**
Cardiology

**Dr Ng Choon Ta**
*Associate Consultant*
**Dept**
Cardiology

**Dr Yap Jiunn Liang Jonathan**
*Associate Consultant*
**Dept**
Cardiology

# NATIONAL NEUROSCIENCE INSTITUTE

Appointments: 6357 7095
Email: appointments@nni.com.sg

## APPOINTMENT

**Dr Chng Soke Miang**
*Senior Consultant*
**Dept**
Neuroradiology

# Don't Limit Your Challenges. Challenge Your Limits.

If you are a qualified doctor, a challenging career awaits you at SingHealth. We seek suitably qualified candidates to join us as:

- **STAFF REGISTRARS / SERVICE REGISTRARS**
- **RESIDENT PHYSICIANS / PHYSICIANS / FAMILY PHYSICIANS / PRIMARY EYECARE PHYSICIANS**

Interested applicants to email CV with full personal particulars, educational and professional qualifications (including housemanship details), career history, present and expected salary, names of at least two professional references, contact numbers and e-mail address together with a non-returnable photograph.

Please email your CV to the respective institutions' email addresses/online career portals with the Reference Number MN1704.

SingHealth

The SingHealth Duke-NUS Academic Medical Centre draws on the collective strengths of SingHealth and Duke-NUS Medical School to drive the transformation of healthcare and provide affordable, accessible, quality healthcare.

With 42 clinical specialties, a network of 2 Hospitals, 5 National Specialty Centres, 9 Polyclinics and Bright Vision Community Hospital, it delivers comprehensive, multidisciplinary and integrated care.

In 2018, the Sengkang General Hospital and Sengkang Community Hospital will be completed to serve the community in the north-east of Singapore. To enhance community care, the new Outram Community Hospital on SGH Campus will be completed in 2020.

## KK Women's and Children's Hospital

**Departments seeking Resident Physicians and Staff Registrars:**

- Diagnostic & Interventional Imaging
- Emergency Medicine
- Haematology / Oncology Service
- Neonatology
- Obstetrics & Gynaecology
- Ophthalmology
- Paediatric Surgery (Urology)
- Women's Anaesthesia

**Website:** www.kkh.com.sg
**Email:** medical.hr@kkh.com.sg

## Sengkang Health

**Departments seeking Resident Physicians and Staff Registrars:**

- Anaesthesiology
- Cardiology
- Emergency Medicine
- General Surgery
- General Medicine (with interest in Endocrinology, Geriatric Medicine, Rehabilitation Medicine, Renal Medicine and Respiratory Medicine)
- Neurology
- Orthopaedic Surgery

**Website:** https://www.ah.com.sg/jobseekers/Pages/JoinUs.aspx
**Email:** careers@skh.com.sg

## National Heart Centre Singapore

**Departments seeking Clinical Associates:**

- Cardiology
- Cardiothoracic Surgery

**Website:** www.nhcs.com.sg
**Email:** hr_mgr@nhcs.com.sg

## National Neuroscience Institute

**Department seeking Resident Physicians and Service Registrars:**

- Neurosurgery

**Website:** www.nni.com.sg
**Email:** nni_hr@nni.com.sg

## Singapore National Eye Centre

- Staff Registrar / Physician
- Staff Registrar / Resident Physician (Ophthalmic Anaesthesiology)
- Primary Eyecare Physician (Full-time / Locum)

**Website:** www.snec.com.sg
**Email:** recruitment@snec.com.sg

## SingHealth Polyclinics

**Seeking Resident Physicians and Family Physicians:**

- Polyclinic (Family Medicine)

**Website:** http://polyclinic.singhealth.com.sg
**Email:** hr_admin@singhealth.com.sg

# 16th Asian and Oceanian Myology Center Annual Scientific Meeting 2017

***Enabled Living - Disabled but Not Handicapped***
*Artwork painted by Mr William Ngo, a patient with muscular dystrophy and an artist from the Mouth & Foot Painting Artists Pte Ltd (MFPA)*

Themed *Enabled Living – Disabled but Not Handicapped*, this year's meeting, organised by National Neuroscience Institute (NNI), will focus on the clinical management of common adult and paediatric muscle and neuromuscular diseases, as well as the multidisciplinary approach to enabled living – helping patients overcome their disability to lead fulfilling lives.

The meeting will also involve patients, caregivers, patient support and patient advocacy groups from the region to broaden the depth of discussion beyond medicine.

In addition, there will be an educational workshop run by international experts on diseases of muscle and neuromuscular junction.

**Date**
6 – 8 August 2017 (Sunday – Tuesday)

**Time**
*Refer to event website*

**Venue**
Grand Copthorne Waterfront Hotel

**CME points**
12 (maximum)

**Fees**
*Refer to event website*

**Contact**
National Neuroscience Institute
11 Jalan Tan Tock Seng
Singapore 308433
Tel: 6357 7152/7640
Fax: 6256 4755
Email: nni_secretariat@nni.com.sg

**Registration is required.**
For more details or to register, visit
**www.nni.com.sg/education/events/Pages/16thAOMC.aspx**

# *GP Seminar*
# Neuromuscular Disorders and Neuropathic Pain

The Ministry of Health encourages GPs to take on a bigger role in managing patients in the community. In line with this, it has always been our aim to provide GPs with practical skills and updated knowledge of evidence-based, cost-effective treatment for common neurological disorders seen in your clinics.

At the end of the seminar, participants should be able to do the following:

1. Formulate an approach for diagnosis of neuromuscular weakness and numbness.
2. Discuss the diagnosis, prognosis, and management of Bell's palsy, carpal tunnel syndrome, cervical and lumbosacral radiculopathies, peroneal nerve palsy, and meralgia paresthetica.
3. Describe the pathogenesis and clinical features of neuropathic pain.
4. Review the different classes of medications for treatment of neuropathic pain.
5. Prescribe treatment for neuropathic pain according to the different mechanisms of the pain.

**Date**
19 August 2017 (Saturday)

**Time**
1.00 pm – 3.45 pm

**Venue**
National Neuroscience Institute
Exhibition Hall, B1

**CME points**
2

**Fees**
Free

**Contact**
National Neuroscience Institute
11 Jalan Tan Tock Seng
Singapore 308433
Tel: 6357 7152

**Registration is required.**

Courses

# 5th Coronary Care Symposium

The Coronary Care Symposium is a basic course in coronary intensive care. There will be dedicated hands-on workshops and facilitated interactive case discussions which cover important management concepts and in-depth learning of the various tools and techniques essential to daily cardiac intensive care.

**Date**
9 September 2017 (Saturday)

**Time**
10.00 am – 5.30 pm
*(Registration starts at 9.30 am)*

**Venue**
National Heart Centre Singapore
Level 7 Lecture Theatre

**CME points**
Application in process

**Fees**
Physicians/Doctors in-training:
$200.00
Medical Students:
$50.00

**Contact**
Email: nhccme@nhcs.com.sg
Tel: 6704 2389/2382

**Registration is required.**
*Limited seats are available, and are reserved on a first-come-first-served basis.*
For more details or to register, visit **www.nhcs.com.sg**

# 3rd Neuro-Oncology Symposium

**Date**
25 – 26 September 2017
(Monday – Tuesday)

**Time**
8.30 am – 5.30 pm
(Both days)

**Venue**
Duke-NUS Medical School,
Amphitheatre

**CME points**
Application in process

**Fees**
$50.00

**Contact**
National Neuroscience Institute
Tel: 6357 7163/7541
Fax: 6256 4755
Email: nni_secretariat@nni.com.sg

**Registration is required.**
For more details, visit **www.nni.com.sg/education/events**

SingHealth
www.singhealth.com.sg

## GP FAST TRACK APPOINTMENT HOTLINES

| | |
|---|---|
| Singapore General Hospital | 6321 4402 |
| KK Women's and Children's Hospital | 6294 4050 |
| Sengkang Health | 6472 2000 |
| National Cancer Centre Singapore | 6436 8288 |
| National Dental Centre Singapore | 6324 8798 |
| National Heart Centre Sing pore | 6704 2222 |
| National Neuroscience Institute | 6357 7095 |
| Singapore National Eye Centre | 6322 9399 |

## DIRECT WARD REFERRAL CONTACT NUMBERS

| | |
|---|---|
| Singapore General Hospital | 6321 4822 |
| KK Women's and Children's Hospital | 6394 1180 |

## SINGHEALTH DUKE-NUS ACADEMIC MEDICAL CENTRE

- Singapore General Hospital
- KK Women's and Children's Hospital
- Sengkang Health
- National Cancer Centre Singapore
- National Dental Centre Sing pore
- National Heart Centre Singapore
- National Neuroscience Institute
- Singapore National Eye Centre
- Polyclinics SingHealth
- Bright Vision Hospital

Reg. No.: 200002698Z