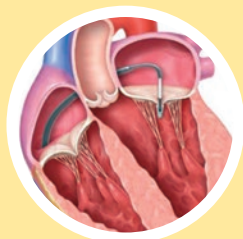


# MURMURS®

A publication of  
National Heart Centre  
Singapore (NHCS)



20 YEARS: JOURNEYING  
AS ONE HEART, TWO  
DECADES OF MEMORIES



MITRACLIP THERAPY:  
NON-INVASIVE TREATMENT  
FOR LEAKY HEART VALVES

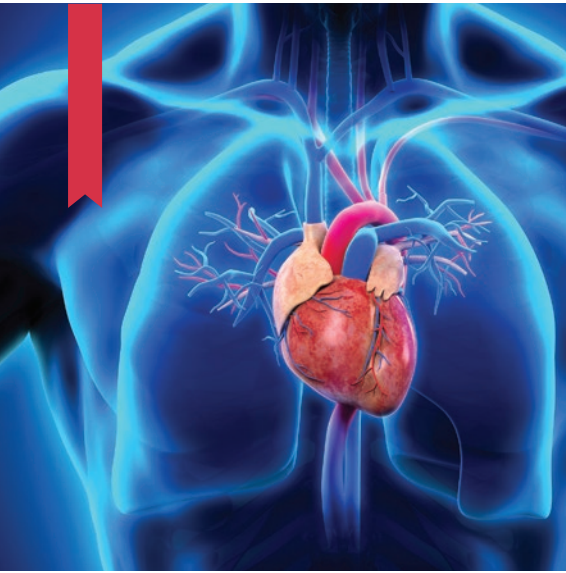


IMPROVED OUTCOMES  
FOR HEART FAILURE PATIENTS  
WHEN GUIDELINE-DIRECTED  
MEDICAL THERAPIES ARE  
FOLLOWED



*Mr Ong (seated) together with his multi-disciplinary team of NHCS and SGH doctors, who had treated him for his CTEPH.*

## NEW HOPE FOR PATIENTS WITH BLOOD CLOTS IN LUNGS



## NEW HOPE FOR PATIENTS WITH BLOOD CLOTS IN LUNGS

Patients with Chronic Thromboembolic Pulmonary Hypertension (CTEPH), a disease of the blood vessels of the lungs caused by persistent blood clots, are now able to undergo a surgery to remove the clots. The open-heart surgery, previously not readily available in the region, is part of the comprehensive CTEPH clinical service offered by NHCS.

**M**r Ong Chee Fatt, a 57-year-old polytechnic lecturer, used to be an avid runner who can do 3km or 4km run every day without fail, until he began experiencing breathing difficulties in 2010. He started having bad coughs and shortness of breath, and realised then that he could no longer run long distance without taking regular breaks. He was subsequently diagnosed with CTEPH in 2013.

It is estimated that there are a few hundred CTEPH patients in Singapore. The condition, not widely known, has common symptoms, such as what Mr Ong had experienced, and it will progressively worsen and affect breathing, sleeping and walking. CTEPH patients who do not receive treatment will usually not survive beyond seven years, or three years for those with more serious conditions. On average, one-third of CTEPH patients would succumb to the condition if no treatment is rendered.

### FIRST COMPREHENSIVE, MULTI-DISCIPLINARY PROGRAMME

The introduction of the CTEPH clinical service in NHCS gave patients such as Mr Ong a new lease of life. The programme, which started in 2016, is the first in Singapore to offer comprehensive treatment options – pulmonary endarterectomy, balloon angioplasty and medical therapy, for CTEPH patients. The service provides full spectrum of care including diagnostic investigations, customised treatment options and follow-up care for the patients.

Pulmonary endarterectomy, the open-heart surgery which Mr Ong underwent, is an operation carried out to remove blood clots from the pulmonary arteries in the lungs to allow blood flow. The curative but complex surgery involves a heart-lung bypass machine that will take over the function of the heart and lungs, and requires the body to be gradually chilled to 20 degrees Celsius in order to slow down metabolism. The cooling process is necessary to protect the brain and other organs from damage.

Doctors will then have 20 minutes to remove the clots once the machine has taken over the circulation and drained the blood from the body. The whole operation takes about seven to eight hours and is undertaken by specially trained doctors and support staff, working closely as a team.

Some CTEPH patients, who may be deemed unsuitable or high risk for pulmonary endarterectomy due to various factors such as advanced age, distal disease (small vessel disease) or multiple comorbidities, will be recommended the alternative treatment option from the CTEPH programme. Balloon pulmonary angioplasty is a minimally invasive procedure which may be suitable for such patients.





*Climbing stairs is now no longer a tedious task for Mr Ong after his successful surgery.*

Unlike pulmonary endarterectomy which involves the surgical removal of the blood clots, balloon pulmonary angioplasty uses catheter to pass through the blood vessel and position a balloon device that is subsequently inflated to push the blood clots aside and restore blood flow. Patients who underwent the balloon pulmonary angioplasty option typically need to undergo the procedure a few times to completely treat their blockages. Patients who are deemed unsuitable for pulmonary endarterectomy and balloon pulmonary angioplasty will be offered medical therapy to prevent clot formation and lower their lung pressure.

**“Due to the non-specific nature of symptoms and lack of awareness of the condition, many cases may go undiagnosed. It is important that we raise awareness of this condition so that more can be diagnosed and treated early,”** said Assoc Prof Lim Soo Teik, Deputy Medical Director and Senior Consultant, Department of Cardiology, NHCS.

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### NHCS CARDIAC INTERVENTIONAL PROCEDURES

Interventional cardiology involves treating patients with disease of the heart vessels or coronary artery disease. The interventional cardiology programme is supported by catheterisation laboratories which are equipped with features such as biplane and monoplane flat detectors to reduce radiation exposure to patients. They are operational round-the-clock, ensuring that heart attack patients admitted to NHCS will receive timely acute angioplasty to clear up the blocked artery, which leads to better clinical outcomes and survival rates.

- 24/7 Acute Angioplasty
- Adjunctive Coronary Imaging using Intravascular Ultrasound (IVUS) and Optical Coherence Tomography (OCT)
- Cardiac Catheterisation/Angiography
- Coronary Physiologic Measurement (FFR) using Pressure Wire
- Intraaortic Balloon Counterpulsation
- MitraClip Procedure for Severe Mitral Regurgitation
- Mitral, Aortic and Pulmonary Valvuloplasty
- Myocardial Biopsies
- Percutaneous Cardiopulmonary Bypass
- Percutaneous Coronary Interventions
- Peripheral Vascular Intervention
- Renal Denervation
- Right and Left Heart Catheterisation/Angiography
- Transcatheter Aortic Valve Implantation (TAVI)

### OUR INTERVENTIONISTS

Prof Koh Tian Hai	<i>Senior Advisor and Senior Consultant</i>
Assoc Prof Lim Soo Teik	<i>Deputy Medical Director and Senior Consultant Director, Cardiac Catheterisation Laboratory</i>
Assoc Prof Aaron Wong	<i>Head, Department of Cardiology and Senior Consultant Director, Interventional Cardiology</i>
Asst Prof Jack Tan	<i>Deputy Head, Department of Cardiology and Senior Consultant Director, Coronary Care Unit</i>
Assoc Prof Philip Wong	<i>Senior Consultant Deputy Director, NHRIS</i>
Assoc Prof Yeo Khung Keong	<i>Senior Consultant</i>
Assoc Prof Chin Chee Tang	<i>Senior Consultant</i>
Asst Prof Ho Kay Woon	<i>Senior Consultant</i>
Dr Chin Chee Yang	<i>Consultant</i>
Dr Fam Jiang Ming	<i>Consultant</i>
Dr Jonathan Yap	<i>Associate Consultant</i>
Dr Muhammad Bin Idu Jion	<i>Associate Consultant</i>

FOR THE FULL LIST OF NHCS SERVICES AND SPECIALISTS, PLEASE VISIT [www.nhcs.com.sg](http://www.nhcs.com.sg).



## 1999

- Performed first biventricular pacing (for symptomatic relief in patients with moderate to severe heart failure on maximum medical therapy) procedure
- National Heart Centre Singapore became autonomous

In year 2018, the National Heart Centre Singapore celebrates two decades of excellence in Cardiovascular Medicine. We have gone from strength to strength, pioneering many firsts, and in collaboration with local and international partners, been a part of several groundbreaking discoveries. Our milestones have showcased our dedication to medical advancement, together we celebrate:

# 20 YEARS

## 2000

- Jointly offered first Diploma in Biomedical Sciences (Cardiac Technology) offered in Singapore and Asia, with Singapore Polytechnic
- Did first lung transplant with Singapore General Hospital and National Cancer Centre Singapore



## 2006

- Performed Singapore and Asia's first pulmonary vein isolation/ Maze procedure using the EPICOR Cardiac Ablation system
- Established Robotic Assisted Minimally Invasive Cardiothoracic Surgery (RAMICS) Programme

## 2008

- Established Singapore's First Homograft Bank

## 2001

- Established first mechanical heart device programme
- Performed first left ventricular assist device implantation in Singapore and Southeast Asia

## 2005

- First heart hospital outside USA and in Asia to be accredited by the Joint Commission International (JCI)
- Performed first robotic-assisted excision of mediastinal tumour on an 18-year-old male patient using da Vinci surgical system



## 2009

- Performed Asia's first percutaneous closure of the left atrial appendage using the Watchman device
- First robotic hybrid operating theatre in Southeast Asia
- Introduced Southeast Asia's magnetic navigation system for complex arrhythmias, first in Southeast Asia
- Performed Singapore's first Heart Mate II implantation

## 2002

- Performed first left ventricular reconstructive surgery
- Established Singapore's first heart failure programme
- Performed first percutaneous lead extraction in Singapore using the electro-surgical dissection sheath system
- Did the first left ventricular assist device explantation in Singapore and Southeast Asia



## 2003

- Developed first Specialist Diploma in Cardiac Technology with Singapore Polytechnic in Singapore and Asia
- Established Adult Congenital Heart Disease Programme (ACHD)
- Performed first bipolar radiofrequency ablation in Asia



## 2010

- First robotic-assisted lobectomy in Southeast Asia
- EuroPCR partnered SingLIVE to launch inaugural AsiaPCR-SingLIVE



# JOURNEYING AS ONE HEART, TWO DECADES OF MEMORIES



National Heart Centre Singapore  
SingHealth

## 2017

- Collaboration with SingHealth Polyclinics on front-loading and open access protocol that helps patients cut one visit and get a faster diagnosis



Polyclinics  
SingHealth

## 2012

- Implanted Singapore's first third generation heart pump, the HeartWare Ventricular Assist Device, for advanced heart failure patients
- Set up Cardiovascular Academic Clinical Programme
- Developed world's first arrhythmogenic right ventricular cardiomyopathy human heart cell model to study inherited heart muscle disease associated with Sudden Cardiac Death
- Performed Asia's first successful transapical transcatheter mitral valve-in-valve implantation



## 2011

- Successfully created beating heart cells from patient's skin



- Successfully performed Asia's first MitraClip procedure for patients with heart valve problems



- Introduced Asia's first Aquaphereis for heart failure patients with fluid overload



## 2013

- Successfully and completely reversed the effects of a gene mutation in long QT syndrome 2 in patient-specific heart cells, a world's first

## 2014



- Official opening of the NHCS new building by Prime Minister Lee Hsien Loong
- Official launch of the National Heart Research Institute Singapore by President Tony Tan
- Performed Singapore's first Subcutaneous Implantable Cardioverter Defibrillator procedure to prevent Sudden Cardiac Death

## 2016

- Jointly developed cardiac gene sequencing panel with Imperial College London to test 174 genes in 17 inherited cardiac conditions
- Opening of Women's Heart Clinic



- Led multinational study which discovered the gene mutations in Titin affect the heart function in Asians' healthy individuals



## 2015

- Partnered with American College of Cardiology partners to create world's first global diabetes registry
- Official opening of SAF Cardiac Fitness Centre at NHCS



# MITRACLIP THERAPY: NON-INVASIVE TREATMENT FOR LEAKY HEART VALVES

By Dr Wong Ningyan, Associate Consultant,  
and Assoc Prof Yeo Khung Keong, Senior Consultant  
Department of Cardiology

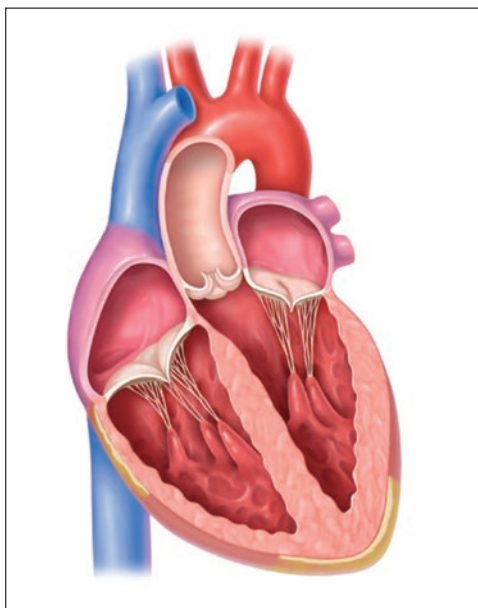
Our heart contains four valves that play a vital role in maintaining blood circulation and keeping blood flowing in the correct direction. When one or more of the heart valves malfunction, they can cause heart valve disease.



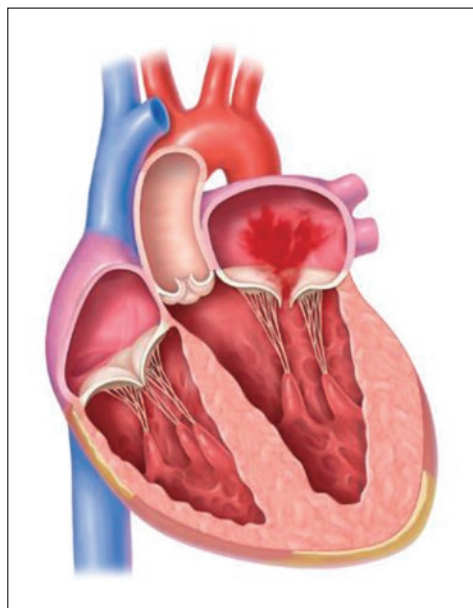
Patients with mild heart valve disease can be monitored without treatment and continue to lead a long and healthy lives. For patients with severe heart valve disease, they are at risk of developing infections and complications such as heart failure and stroke. Heart valve problems are mainly categorised into three types, namely leaky valve or regurgitation where valve does not close properly; stenosis where valve's leaflets thicken, stiffen or fuse; and atresia where valve does not open at all.

## MITRAL REGURGITATION – WHAT IS IT?

The mitral valve, one of the four valves, is located between the left heart chambers (left atrium and left ventricle). Mitral regurgitation is a condition in which the mitral valve leaflets do not close tightly. When this happens, blood flows backward from the left ventricle into the left atrium. The heart must then work harder to push blood through the body, which can cause fatigue, shortness of breath and heart failure. There are several causes of mitral regurgitation and these include deterioration of valve tissue, conditions that weaken the heart muscle and congenital valve abnormalities.



Normal



Mitral Regurgitation

For mild cases, treatment may not be necessary but the severity of leakage needs to be monitored with ultrasound scans of the heart (echocardiograms). For more severe cases, treatment is required. In the past, we only had surgery or medications to treat mitral regurgitation. Surgical treatment involves either repairing or replacing the mitral valve. Mitral valve repair preserves the patient's own valve, while replacement (performed when repair is not possible) replaces the damaged valve with an artificial one. Both methods require open-heart surgery and a heart-lung bypass machine is used to take over the function of the heart while it is being worked on. Medications can be used to help make symptoms more manageable but they do not treat the defect in the mitral valve itself.

## MITRACLIP THERAPY

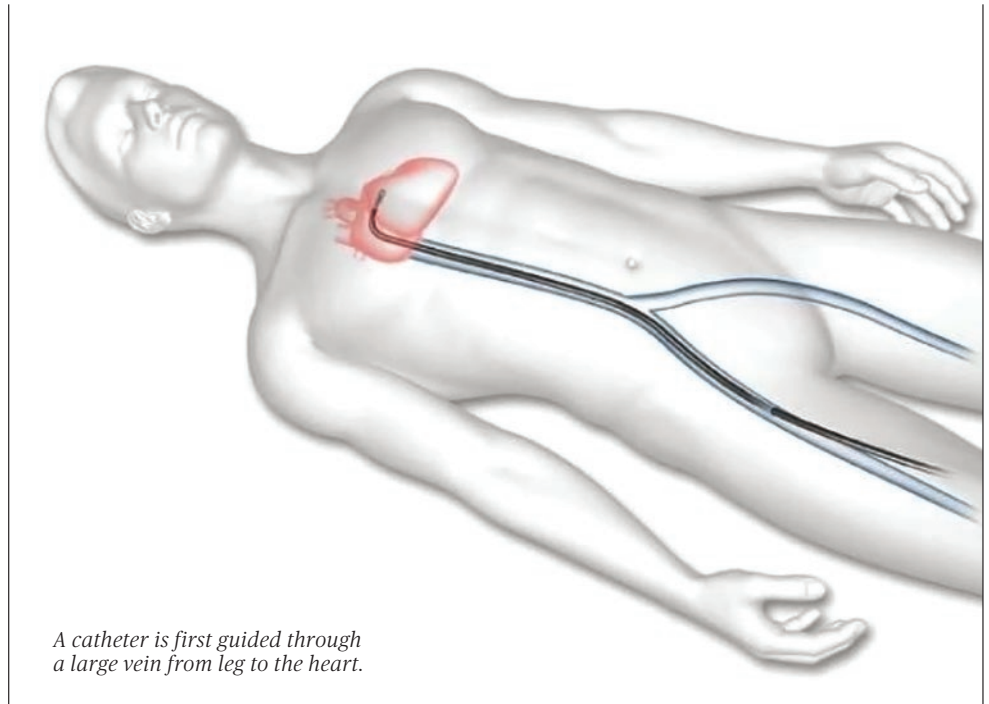
For some patients who have many other medical problems or are very ill, open-heart surgery may be considered as high risk. A minimally invasive procedure called the MitraClip procedure is the alternative option.

The MitraClip device is attached directly to the mitral valve, without opening the chest. To access the mitral valve, a catheter (a long, flexible tube) is guided through a large vein from the leg to reach the heart. The MitraClip device is then passed through the catheter and clipped to the mitral valve, allowing the valves to close more completely and therefore helps to restore normal blood flow through the heart.

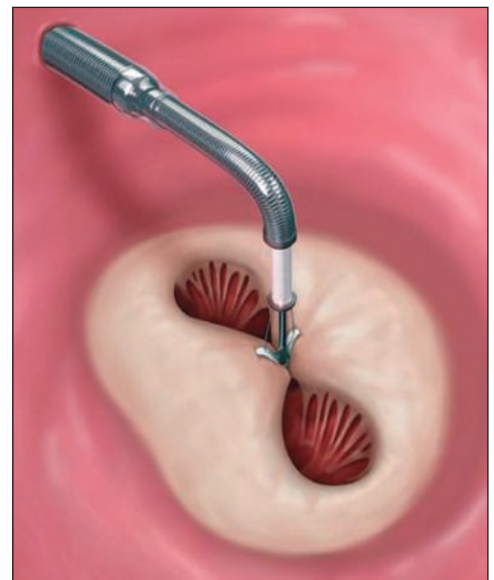
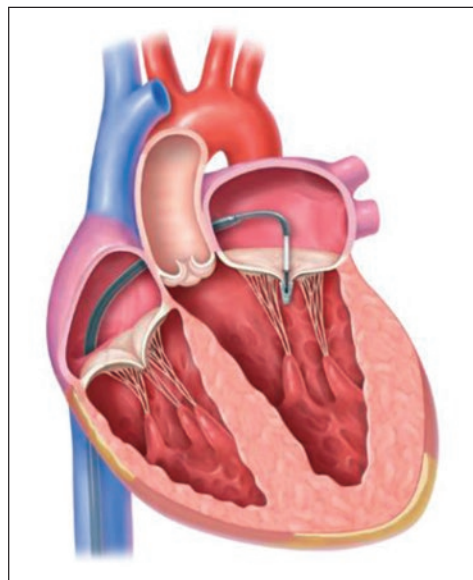
Patients will be admitted one day before the procedure, and stay for another two to three days. The procedure is performed in the cardiac catheterisation laboratory with echocardiographic and x-ray guidance while the patient is under general anaesthesia. The whole procedure takes approximately three to four hours. Complex cases may require a longer procedure time and hospital stay.

**Thus far, the MitraClip has been used in over 50,000 patients worldwide. It has an excellent safety profile and demonstrates consistent results in terms of symptoms relief, reduction in mitral regurgitation as well as hospitalisation for heart failure. At the NHCS, more than 90 patients have undergone the MitraClip therapy since it was made available in Singapore in 2011.**

The MitraClip procedure has its risks but the advantage is that it is less invasive than an open-heart surgery and requires a shorter recovery time. It gives hope to patients who are at high or prohibitive surgical risk, such as those who are elderly and frail, with multiple comorbidities (e.g. lung or kidney conditions) or have previous open-heart surgery.



*A catheter is first guided through a large vein from leg to the heart.*



*The MitraClip device is then passed through the catheter and clipped to the mitral valve to properly close the valve.*

### WHO IS SUITABLE FOR MITRACLIP THERAPY?

Patients with moderate to severe mitral regurgitation and require mitral valve intervention will be referred initially to a cardiac surgeon. If they are deemed unsuitable for surgery, referral will be made to a MitraClip physician. Further clinical examination and investigations will be performed. With this information, the MitraClip team comprising a cardiologist experienced in the MitraClip procedure, an echo cardiologist, a heart failure specialist and a cardiac surgeon, will meet and discuss if patient is suitable for this procedure.

*All illustrations in this article are courtesy of Abbott Structural Heart.*

# IMPROVED OUTCOMES FOR HEART FAILURE PATIENTS WHEN GUIDELINE-DIRECTED MEDICAL THERAPIES ARE FOLLOWED

Research shows that current guidelines for medical therapies at recommended doses are under-utilised in patients with heart failure with reduced ejection fraction (HFrEF). With improved uptake and uptitration of guideline-directed medical therapies, better patient outcomes can be achieved.



**W**hen given a prescription with an increase in the amount of medication to consume, one may naturally be concerned and feel uneasy about the state of their health condition. Conversely, recent research shows that it is important to have medical therapies at the recommended guidelines for heart failure, whereby an uptitration of drugs dosage can result in better outcome for patients.

In a first-ever, multinational real-world data examination of prescription patterns and doses attained for guideline-directed medical therapies in Asian patients suffering from heart failure with HFrEF (refer to visual below), a team of researchers found that the guideline-directed medical therapies at recommended doses are under-utilised in these patients enrolled from across 11 Asian regions in the Asian Sudden Cardiac Death in Heart Failure (ASIAN-HF) registry. These findings were first published in *The Lancet Global Health* journal on September 2018.

The research team, of which eight investigators are from Singapore, analysed prospective data of 5,276 HFrEF patients enrolled in the ASIAN-HF registry since 2012 (where 1066 participants are from Singapore), and studied the prescription patterns and doses attained of guideline-directed medical therapies in Asian HFrEF patients, and the associations with patient outcomes. The research team made the following two observations:

## RECOMMENDED DOSES ARE UNDER-UTILISED

The current evidence-based guidelines for best practice recommend that HFrEF treatment consists of trial-directed doses for angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor antagonists (ARBs) and beta-blockers ( $\beta$  blockers) [these medications help relax blood vessels] as first-line therapy, and mineralocorticoid receptor antagonists (MRAs) as second-line therapy.

Instead of combined therapy, it was observed that monotherapy – that is, only ACE inhibitors, ARB or  $\beta$  blockers – has been prescribed. Despite regional variation across the countries in prescription patterns, the guideline-recommended combination of ACE inhibitors or ARB and  $\beta$  blockers was prescribed in only 55% (or 2,914 patients) of the overall ASIAN-HF cohort of 5,276 HFrEF patients; Singapore fared slightly better with the two medications prescribed at 71%. The under-utilisation of such guideline-directed medical therapies at recommended doses was associated with poorer patient outcomes.

## WIDESPREAD UNDER-DOSING

The failure to achieve the recommended doses of guideline-directed medical therapies was widespread. The recommended doses of ACE inhibitors or ARB were adhered to by only 17% of the patients, compared with 13% for  $\beta$  blockers and 29% for MRAs.

When analysing the relationship between prescribed doses and one-year hospitalisation for heart failure or all-cause mortality rates in HFrEF patients, it was observed that even small doses of ACE inhibitors or ARB and  $\beta$  blockers were associated with lower hospitalisation or mortality rates within a year, compared with no dose or non-usage in the overall ASIAN-HF cohort. However, full recommended doses were associated with the best outcomes.



## KEY TAKEAWAYS

The current analysis represents essential registry data to help guide clinicians treating HFrEF in Asia, as there is no other contemporary data from across the region on prescription patterns and doses attained of guideline-directed medical therapies in patients with HFrEF. There is also limited data on heart failure in multi-regional Asians, who characteristically have smaller body sizes.

The Principal Investigator of ASIAN-HF, Professor Carolyn Lam (Senior Consultant from Department of Cardiology, and Director of Clinical Trials at the NHCS) said,

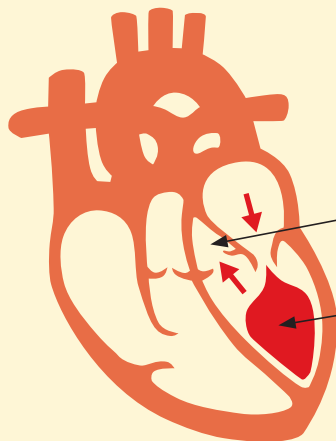
**“The good news is that we are providing the appropriate types of therapies for the majority of our patients in Asia, and that even low doses of these medications are better than none. However, these data also highlight treatment gaps where we may improve upon. This is all the more important in Southeast Asian patients with heart failure, who are on average at least a decade younger than their US or European counterparts, and yet suffer more severe clinical symptoms and worse outcomes.”**

“Our study’s findings support as well as provide valuable insights into the importance of guideline recommendations to start evidence-based therapies in those who are not receiving any therapy, and to increase the doses of ACE inhibitors or ARBs and  $\beta$  blockers to the maximum level of toleration, to achieve maximum benefits among Asian patients with HFrEF,” added Dr Katherine Teng, first author of the research paper and Senior Research Fellow at the NHCS.

To address the knowledge and treatment gaps, the research findings suggest the need for interventions, such as enhancing the efforts and education among physicians to improve the uptake of evidence-based practices and uptitration of guideline-directed medical therapies in the management of heart failure patients; and raising awareness among patients on the importance of guideline-directed medical therapy at targeted doses.

## HEART FAILURE WITH EJECTION FRACTION EXPLAINED

Ejection fraction is the percentage of blood pumped out by one’s heart to the rest of the body, and heart failure with reduced ejection fraction (HFrEF) is a type of heart failure where the ejection fraction is measured at less than 40%.



FORMULA:

$$\frac{\text{AMOUNT OF BLOOD PUMPED OUT}}{\text{AMOUNT OF BLOOD IN THE CHAMBER}} =$$

$$\% \text{ (EF)}$$

**PRESERVED EF**  
55-70%  
IS PUMPED OUT AT EACH HEART BEAT.

**MID-RANGE EF**  
41-49%  
IS PUMPED OUT AT EACH HEART BEAT.

**REDUCED EF**  
 $\leq 40\%$   
IS PUMPED OUT AT EACH HEART BEAT.

# NURTURING THE NEXT GENERATION OF CARDIAC HEALTH AMBASSADORS

Cultivating healthy lifestyles and habits from a young age is key to keeping most heart diseases at bay. At the 4th SingYouth Heart Challenge & Lecture, more than 70 high school and tertiary students submitted abstracts on cardiovascular disease research.

Some 100 students from the local Junior Colleges and Centralised Institutions turned up at the NHCS Lecture Theatre to attend the SingYouth Heart Lecture, which aims to spark youths' interest in cardiovascular medicine, and hopefully, in turn become ambassadors of cardiac health among their family and student community.

First was an interactive lecture and Q&A session on new heart disease therapies by NHCS cardiologists Dr Eric Lim and Dr Guna, followed by Dr Jonathan Yap who spoke about technology in healthcare. It was an eye-opener as students learned how technology advancements progress into the novel therapies used in heart disease treatments today.



*Guest-of-Honour, Dr Tong, shared his experience on performing the first heart transplant in Singapore.*

Old newspaper clippings, yellowish photographs and a close up shot of a sliced-up heart. Everyone's attention was then on the Guest-of-Honour, renowned cardiothoracic surgeon Dr Tong Ming Chuan, as he related his compelling experience in leading the medical team to perform the first ever heart transplant surgery in Singapore in 1990, and shared about how the evolution of heart transplantation has benefitted heart patients in Singapore and Asia.

Prior to the SingYouth Heart Lecture, the students had formed 28 teams to submit abstract papers and posters related to cardiovascular disease, and three teams were shortlisted to present their abstracts in front of a panel of judges on the day itself. The presentations were lively and engaging, and certainly kept the audience entertained.

As shared candidly by one of the student participant, "Our team's project was a small one with a lot of learning potential. Seeing how other competing teams take on so many different directions and interpreting the topic in creative ways has really inspired me to be more creative when it comes to doing research. This Challenge has also raised our awareness on important health issues in our everyday lives, and I will take part in this competition again, if given the chance."

Prizes were then given out for the Best Abstract, Best Poster and Best Oral Presentation. Congratulations go out to the three group winners, who were each awarded \$500 courtesy of Edwards Lifesciences Foundation. It was an enriching learning experience for the teens, and it was great to see how they embraced the spirit of the Challenge with interest and enthusiasm!

As Prof Terrance Chua, NHCS's Medical Director, shared, "Since our launch in 2015, the number of student participants has grown. It's heartening to see growing support from the schools for this educational event, which serves as a good learning platform for the students, our future generation, to gain insights into the world of cardiovascular disease, its prevention, and how treatments and research can help improve the lives of heart patients."



*It was certainly an enriching learning journey for the 28 teams who participated in the Challenge.*



*The Best Abstract was won by River Valley High School for their investigation on the different effects of waking during deep and light sleep.*



*Nanyang Junior College won the Best Poster, for their review on the effects of coffee consumption on cardiovascular risk factors among Asians.*



*The Best Oral Presentation was awarded to Dunman High School, who presented on society's receptiveness towards current hypertensive treatments, and the optimisation of available treatments.*

**SingYouth Heart Challenge is sponsored by Edwards Lifesciences Foundation.**



# RESEARCH PUBLICATIONS

## AUGUST – DECEMBER 2018

### AUGUST 2018

- Heart failure with mid-range ejection fraction in CHARM: characteristics, outcomes and effect of candesartan across the entire ejection fraction spectrum** *Eur J Heart Fail.* 2018 Aug;20(8):1230-1239. doi: 10.1002/ehf.1149
- Prevalence, clinical correlates, and outcomes of anaemia in multi-ethnic Asian patients with heart failure with reduced ejection fraction** *ESC Heart Fail.* 2018 Aug;5(4):570-578. doi: 10.1002/ehf2.12279
- Heart failure with preserved ejection fraction: from mechanisms to therapies** *Eur Heart J.* 2018 Aug 7;39(30):2780-2792. doi: 10.1093/eurheartj/ehy301
- Fractal analysis of right ventricular trabeculae in pulmonary hypertension** *Radiology.* 2018 Aug;288(2):386-395. doi: 10.1148/radiol.2018172821
- Mortality outcome and predictive risk factors for death in patients with heart failure and reduced ejection fraction who declined implantable cardioverter defibrillator implantation in Singapore** *J Arrhythm.* 2018 Aug 18;34(5):536-540. doi: 10.1002/joa3.12106
- Responses of endothelial cells towards ischemic conditioning following acute myocardial infarction** *Cond Med.* 2018 Aug;1(5):247-258
- Remote ischemic conditioning in ST-segment elevation myocardial infarction - an update** *Cond Med.* 2018 Aug;1(5):13-22
- Impact of baseline hemodynamics on the effects of a transcatheter interatrial shunt device in heart failure with preserved ejection fraction** *Circ Heart Fail.* 2018 Aug;11(8):e004540. doi: 10.1161/CIRCHEARTFAILURE.117.004540
- First medical contact-to-device time and heart failure outcomes among patients undergoing primary percutaneous coronary intervention** *Circ Cardiovasc Qual Outcomes.* 2018 Aug;11(8):e004699. doi: 10.1161/CIRCOUTCOMES.118.004699

### SEPTEMBER 2018

- Thrombogenicity at the jailed side branch ostia in provisional stenting technique: insights from an in vitro model** *EuroIntervention.* 2018 Sep 20;14(7):826-827. doi: 10.4244/EIJ-D-18-00003
- Regional variations in hospital management and post-discharge mortality in patients with non-ST-segment elevation acute coronary syndrome** *Clin Res Cardiol.* 2018 Sep;107(9):836-844. doi: 10.1007/s00392-018-1254-y
- Advanced analyses of computed tomography coronary angiography can help discriminate ischemic lesions** *Int J Cardiol.* 2018 Sep 15;267:208-214. doi: 10.1016/j.ijcard.2018.04.020
- Cardiac resynchronisation therapy in paediatric patients with pacing induced cardiomyopathy - A single centre experience** *Indian Pacing Electrophysiol J.* 2018 Sep - Oct;18(5):180-182. doi: 10.1016/j.ipej.2018.05.002
- Correlation with invasive left ventricular filling pressures and prognostic relevance of the echocardiographic diastolic parameters used in the 2016 ESC heart failure guidelines and in the 2016 ASE/EACVI recommendations: a systematic review in patients with heart failure with preserved ejection fraction** *Eur J Heart Fail.* 2018 Sep;20(9):1303-1311. doi: 10.1002/ehf.1220
- Patterns of glucose-lowering medication use in patients with type 2 diabetes and heart failure. Insights from the diabetes collaborative registry (DCR)** *Am Heart J.* 2018 Sep;203:25-29. doi: 10.1016/j.ahj.2018.05.016
- Prescribing patterns of evidence-based heart failure pharmacotherapy and outcomes in the ASIAN-HF registry: a cohort study** *Lancet Glob Health.* 2018 Sep;6(9):e1008-e1018. doi: 10.1016/S2214-109X(18)30306-1
- Solid organ transplantation in Singapore** *Transplantation.* 2018 Sep;102(9):1397-1400. doi: 10.1097/TP.0000000000002235
- Normal values of myocardial deformation assessed by cardiovascular magnetic resonance feature tracking in a healthy chinese population: A multicenter study** *Front Physiol.* 2018 Sep 3;9:1181. doi: 10.3389/fphys.2018.01181
- Identifying pathophysiological mechanisms in heart failure with reduced versus preserved ejection fraction** *J Am Coll Cardiol.* 2018 Sep 4;72(10):1081-1090. doi: 10.1016/j.jacc.2018.06.050
- Factors determining fast-track failure post cardiac surgery** *Ann Heart Fail.* 2018, 3(1):55-59, Volume 3 | Issue 1
- Study protocol for a cohort study of patients with advanced heart failure in Singapore** *BMJ Open.* 2018 Sep 17;8(9):e022248. doi: 10.1136/bmjopen-2018-022248
- The inaugural SingHealth uportal video-assisted thoracoscopic surgery masterclass in Singapore** *J Vis Surg.* 2018;4:200. doi: 10.21037/jovs.2018.09.01
- Associations between understanding of current treatment intent, communication with healthcare providers, preferences for invasive life-sustaining interventions and decisional conflict: results from a survey of patients with advanced heart failure in Singapore** *BMJ Open.* 2018 Sep 19;8(9):e021688. doi: 10.1136/bmjopen-2018-021688
- Quantification of biventricular strains in heart failure with preserved ejection fraction patient using hyperelastic warping method** *Front Physiol.* 2018 Sep 19;9:1295. doi: 10.3389/fphys.2018.01295
- Renal function and exercise training in ambulatory heart failure patients with a reduced ejection fraction** *Am J Cardiol.* 2018 Sep 15;122(6):999-1007. doi: 10.1016/j.amjcard.2018.06.011
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