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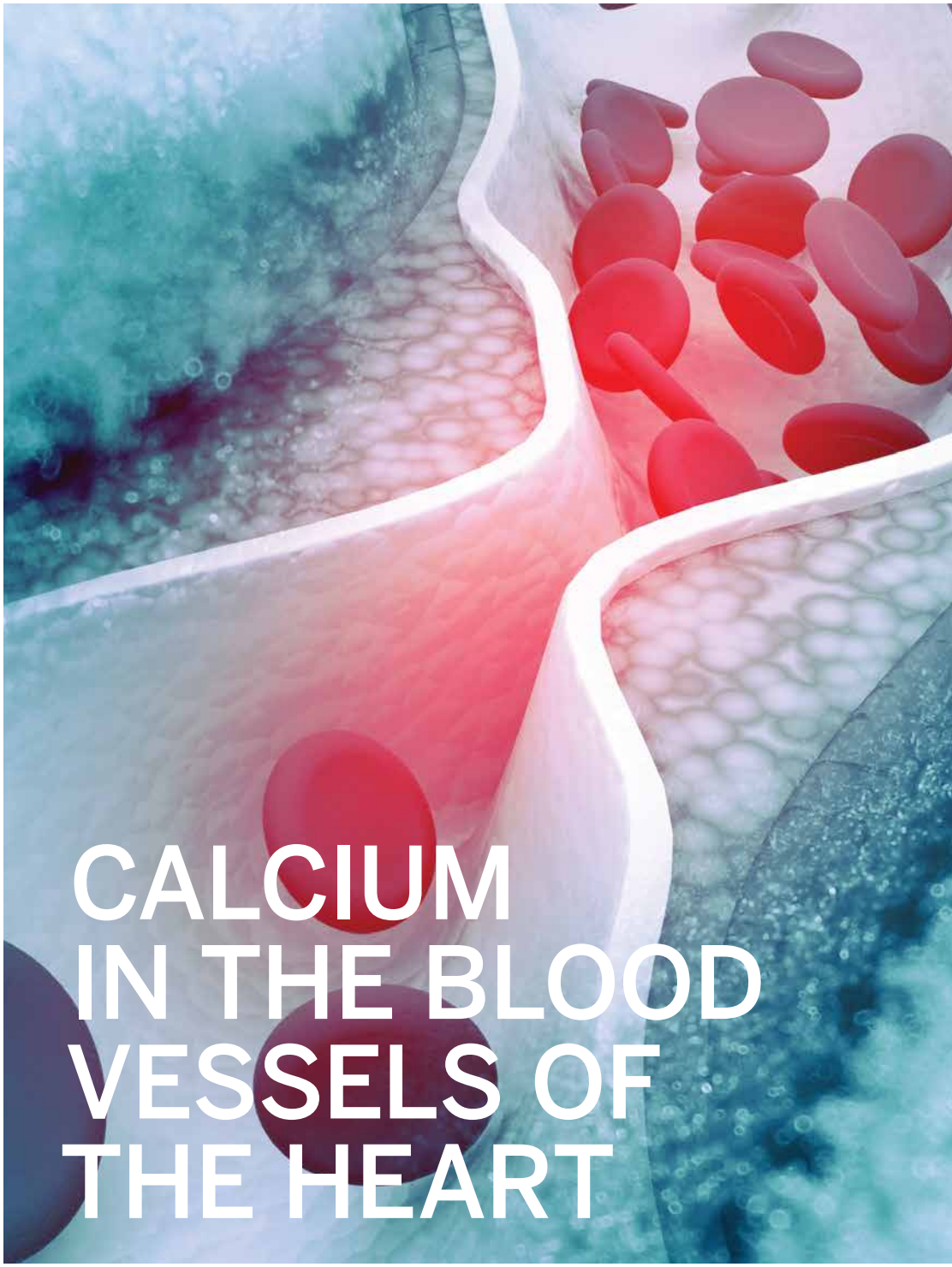
MANAGING HEART FAILURE

FOR PHYSICIANS: UPDATES ON LIPIDS MANAGEMENT GUIDELINES

COVID-19, BLOOD CLOTS AND HEART ATTACKS



CALCIUM IN THE BLOOD VESSELS OF THE HEART

National Heart Centre Singapore
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CALCIUM IN THE BLOOD VESSELS OF THE HEART

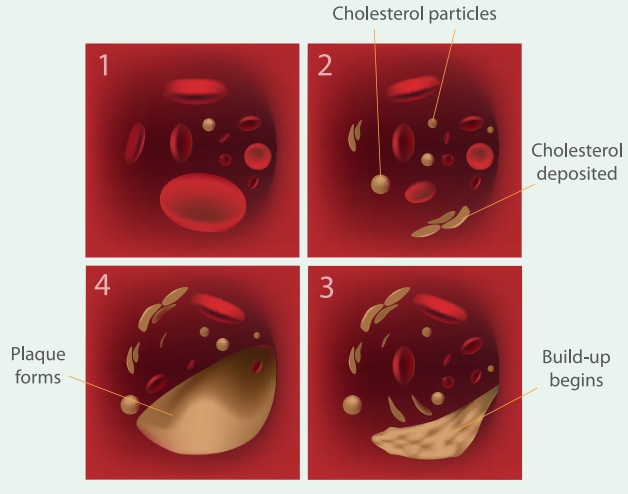
By Dr Jonathan Yap, Consultant, Department of Cardiology and
Assoc Prof Aaron Wong, Head & Senior Consultant, Department of Cardiology

One frequently asked question that heart doctors face is "How does coronary artery disease happen?" The main process behind the development of this disease is atherosclerosis. Atherosclerosis occurs over time with the deposition of plaque in the major blood vessels of the heart causing narrowing of the blood vessel and subsequently reduced blood flow to the heart muscles.

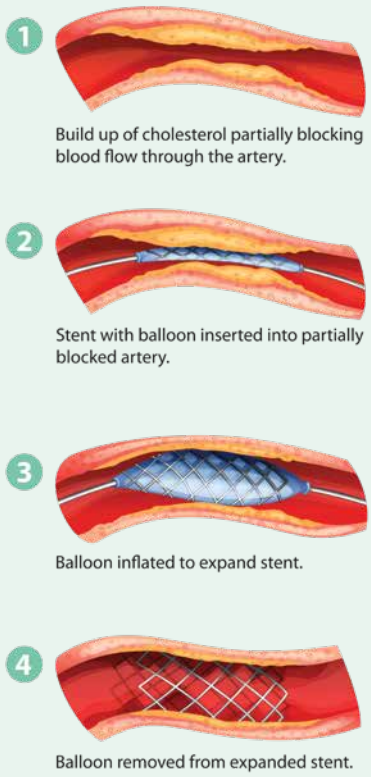
The plaque can consist of different types of materials including fats, fibrous tissue and calcium. The formation of plaque in the blood vessels is a result of a multitude of different factors and varies from person to person. These include age, gender, genetics, lifestyle, smoking and cardiac risk factors like diabetes, high blood pressure and high cholesterol. When the blockage is tight, common symptoms experienced include chest pain and shortness of breath, especially on exertion. This can also lead to heart attack.

Treatment of coronary artery disease is multi-fold. Prevention, lifestyle modifications, control of risk factors and medications form the firm foundation of the treatment of this disease. With persistent symptoms despite adequate medical therapy, invasive treatment options can be considered. These include percutaneous coronary intervention for example, coronary stenting or coronary artery bypass (in the setting of multivessel disease).

Of the different types of blockages, calcified plaque poses a greater challenge for interventional cardiologists. Calcified blockages tend to be 'rock-hard' and as such, more difficult to 'open up' with the conventional equipment. Fortunately, the development and availability of specialised technology, helps interventional cardiologists tackle these calcified lesions. The specialised devices used to treat these calcified blockages can be grouped largely into two groups – 'balloons' and 'drills'.

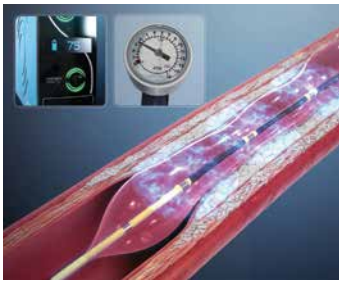


Atherosclerosis - forming of plaque in the artery.

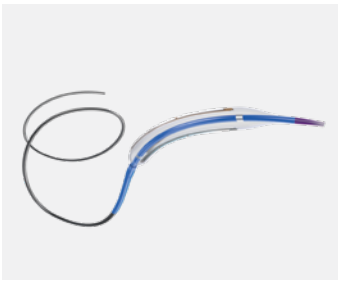


The process of stenting.

Using Specialised 'Balloon' Technology



Intravascular Lithotripsy
(Credits: Shockwave Medical Inc.)



Wolverine Cutting Balloon
(Credits: Boston Scientific)

In routine cases of percutaneous coronary intervention, a wire is placed across the blocked artery and a small balloon is treaded over the wire to the area of blockage. The balloon is then dilated to 'open up' the blood vessel prior to placing a stent (metal scaffold to help keep the artery open). For calcified lesions that tend to be very hard, it may be difficult opening up the lesion using the normal balloon. The two types of specialised balloons available for calcified lesions are namely cutting balloon and intravascular lithotripsy (IVL) balloon. The cutting balloon is embedded with several tiny blades. When inflated, these tiny blades create microscopic cuts in the calcium allowing the calcium to break open and the blockages to be adequately dilated. The IVL balloon, developed in recent times, is based on the same lithotripsy concept of using ultrasound waves to help breakdown kidney stones. The IVL balloon emits sound waves that will help modify and crack the calcium, allowing the calcified lesion to be more easily dilated thereafter.

The Use of 'Drilling' Devices

Rotablator
(Credits: Boston Scientific)

Coronary orbital atherectomy system
(Credits: OrbusNeich Medical Pte Ltd.)

There are two main 'drilling' techniques that interventional cardiologists use to deal with complex lesions - rotablation and orbital atherectomy. While technical differences exist, in general these devices consist of a burr/crown that is coated with diamond. The diamond coating results in the device being 'harder' than calcium, allowing the calcium to be 'shaved' away when the device comes in contact with the calcium. After placing a specialised wire across the blockage, the device is activated over the wire to spin at high speeds (in the tens of thousands to hundreds of thousands revolutions per minute). This spinning action helps abrade away the inner areas of calcium.

Other techniques such as the use of laser, exist but these are currently not available in Singapore. The exact technique used to deal with calcified lesions will depend on the clinical scenario and may also involve a combination of various techniques. While calcified lesions used to pose much difficulties to the interventional cardiologists, the advent of these technologies have helped facilitate a smoother procedure with improved outcomes for the patients.

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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
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- Percutaneous Coronary Interventions - Stenting and Atherectomy; Congenital Structural Heart Intervention; Percutaneous Valve Intervention; Left Atrial Appendage Closure)
- Peripheral Vascular Intervention
- Renal Denervation
- Right and Left Heart Catheterisation/Angiography
- Transcatheter Aortic Valve Implantation (TAVI)

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Asst Prof Ho Kay Woon	Senior Consultant
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For the full list of NHCS services and specialists, please visit www.nhcs.com.sg.

MANAGING HEART FAILURE

By Dr Ng Choon Ta, Consultant, Department of Cardiology

In patients with heart failure, there is impaired ability of the heart to effectively pump blood around the body. This could be due to a weak or stiff heart. Although heart failure can occur at any age, it tends to occur more frequently in older patients. Common symptoms include breathlessness with physical activity or when lying flat in bed, and water retention such as leg swelling.

Compared to the western population, the onset of heart failure in Singapore occurs earlier and at a younger age. The average age of onset is at 50 years old in Singapore as compared to 60 years old in the west. A significant number of patients also have pre-existing medical conditions such as diabetes mellitus.

Classifying Heart Failure

Most patients with heart failure are diagnosed when they have clinical signs and symptoms, with the aid of imaging tools such as echocardiography or cardiac magnetic resonance imaging, and blood tests for special biomarkers.

Heart failure can be classified into two main groups: heart failure with preserved ejection fraction (HFpEF) or heart failure with reduced ejection fraction (HFrEF). The left ventricle ejection fraction, which measures how much blood gets pumped out per cardiac cycle, is an indicator of how well the heart is pumping and can be used to help classify heart failure and subsequently guide treatment. Assessment of the heart function can be performed using transthoracic echocardiogram or cardiac magnetic resonance imaging.

HFrEF

In HFrEF, the pump function of the heart is weak, and patients usually have a left ventricle ejection fraction of less than 40%. This could be due to coronary artery disease or hereditary conditions.

HFpEF

In HFpEF, the systolic heart function is normal (left ventricle ejection fraction of 50% and above) but the heart muscle is stiff. Consequently, there is ineffective filling up and pumping of blood around the body. Stiffness of heart muscle can occur due to a variety of reasons such as ageing, long-standing high blood pressure or obesity.

Optimal Medical Therapy

The care of heart failure patients involves a multi-disciplinary approach. At NHCS, there is a dedicated heart failure team comprising heart failure cardiologists, trained heart failure nurses, pharmacists, physiotherapists, dieticians, transplant coordinators and medical social workers to look after the needs of this unique group of patients. Referral to a cardiologist for workup and early initiation of medical therapy is important. Patients are advised to restrict their fluid intake, and to take a low-salt diet. They should also go for regular influenza and pneumococcal vaccinations. For smokers, they are advised to quit smoking. In the community, our primary care physicians also play a pivotal role in ensuring that chronic medical conditions such as high blood pressure, high blood cholesterol and diabetes mellitus are well controlled.

Although heart failure is a chronic disease, medications can help improve symptoms and reduce frequency of hospitalisations. In the past decade, there has been tremendous progress in the pharmacological sector, with new and effective classes of medications being discovered. Recently, the Heart Failure Society (Singapore) published an updated 2020 clinical practice guidelines on heart failure intended for healthcare professionals.

For patients with heart failure with preserved ejection fraction, novel agents such as angiotensin receptor neprilysin inhibitors (ARNIs) and sodium glucose cotransporter inhibitors have shown to significantly decrease mortality and hospitalisation in clinical trials. This is in addition to standard medications such as beta blockers and mineralocorticoid receptor antagonists.

ARNI is recommended as a replacement for angiotensin-converting enzyme inhibitors (ACEi) or angiotensin II receptor blockers (ARB) to further reduce the risk of heart failure hospitalisation and death in patients with HFrEF who remain symptomatic despite optimal treatment. When replacing ACEi with ARNI, physicians should stop existing ACEi for at least 36 hours before initiation of ARNI to reduce the risk of adverse effects.

Sodium-Glucose Cotransporter-2 Inhibitors (SGLT2i) have shown to reduce the risk of heart failure-associated events in patients with type 2 diabetes and concomitant renal impairment. In recent clinical trials, SGLT2i such as dapagliflozin and empagliflozin have shown to reduce the risk of heart failure hospitalisation and death in patients with HFrEF who remain symptomatic despite optimal medical treatment, even in non-diabetic patients.

To date, there is no proven therapy to improve survival and reduced morbidity in HFpEF. The treatment of HFpEF lies in managing co-existing conditions such as high blood pressure and diabetes mellitus, controlling symptoms and treating precipitating factors.

While optimal medical therapy in heart failure patients significantly reduces the risk of sudden cardiac death, those with severely impaired heart function of less than 35% may benefit from devices such as Implantable Cardioverter Defibrillator (ICD) to reduce the risks of life threatening arrhythmias (abnormal heart rhythm).

What happens in advanced heart failure?

Advance care planning is important for heart failure patients to make plans about their future health care, especially when they are not in a position to make or communicate their healthcare choices. Shared decision-making among patients, their families, and the medical team in establishing the goals of care should be initiated early. Unlike cancer patients, some heart failure patients can experience an unpredictable pattern of decline.

Heart transplantation can be considered for advanced heart failure in selected patients who are repeatedly hospitalised despite being on optimal medical therapy. Mechanical heart pumps such as the Left Ventricular Assist Device can be considered as a permanent or destination therapy in selected patients with refractory advanced heart failure.

In summary, heart failure is an increasingly common condition in Singapore. Multi-disciplinary care and a combination of appropriate medications, lifestyle modifications, and accessibility to care can help to improve symptoms and reduce hospitalisation.

(For healthcare professionals: The full version of the 2020 Clinical Practice Guidelines on Diagnosis and Management of Heart Failure published by the Heart Failure Society (Singapore) is now available for download at https://www.hfss.org.sg/ under Resources (Professional Guidelines))

FOR PHYSICIANS

UPDATES ON LIPIDS MANAGEMENT GUIDELINES

By Dr Natalie Koh, Consultant, Department of Cardiology

In view of the emergence of a substantial body of evidence in recent years, lipid management guidelines from European Society of Cardiology (ESC), European Atherosclerosis Society (EAS) (2019)[1], American Heart Association (AHA) and American College of Cardiology (ACC) (2018)[2] have undergone significant updates since the previous recommendations in 2016 and 2013, respectively. The establishment of goal-directed medical therapy with lower low-density lipoprotein cholesterol (LDL-C) thresholds and guidelines on non-statin therapy use are the most significant updates between previous and current guidelines.

The key to managing lipids is first understanding the patient's cardiovascular risk and then tailoring treatment to reach risk-appropriate LDL-C thresholds. Based on the treatment goals, the prescribing physician needs to decide the intensity of statins to initiate treatment with, and what non-statin therapy may be indicated if goals cannot be met despite maximal tolerated statin therapy.

Defining Cardiovascular Risk

The ESC and EAS define cardiovascular risk estimation as part of a continuum ranging from very high risk, high risk, moderate risk and low risk. The cut-off points that were used to define risk are in part, both arbitrary and based on evidence from clinical trials. The 2018 definition by AHA and ACC divides the population into primary and secondary prevention cohorts, and the secondary prevention cohort is further divided into high risk versus very high risk. Very high risk cohorts have a history of multiple major atherosclerotic cardiovascular disease (ASCVD) events or one major ASCVD event and multiple high-risk conditions.

LDL-C Treatment Goals and Thresholds

The 2019 ESC and EAS guidelines recommend lowering LDL-C to as low a level as possible, because evidence suggests that lowering LDL-C beyond the goals previously set in 2016 is associated with fewer ASCVD events. Compared to the 2016 guidelines, the LDL-C threshold for the very high risk cohort is now < 1.4 mmol/L AND a ≥ 50% reduction from baseline (see Table 1).

CV Risk Category	LDL-C Goals	
	2016 Guidelines	2019 Guidelines
Very high risk	LDL-C < 1.8 mmol/L (< 70 mg/dL) **OR** ≥ 50% reduction if baseline LDL-C is 1.8–3.5 mmol/L (70–135 mg/dL)	LDL-C < 1.4 mmol/L (< 55 mg/dL) **AND** ≥ 50% LDL-C reduction from baseline
High risk	LDL-C < 2.6 mmol/L (< 100 mg/dL) **OR** ≥ 50% reduction if baseline LDL-C is 2.6–5.2 mmol/L (100–200 mg/dL)	LDL-C < 1.8 mmol/L (< 70 mg/dL) **AND** ≥ 50% LDL-C reduction from baseline
Moderate risk	< 3.0 mmol/L (< 116 mg/dL)	LDL-C < 2.6 mmol/L (< 100 mg/dL)
Low risk	< 3.0 mmol/L (< 116 mg/dL)	LDL-C < 3.0 mmol/L (< 116 mg/dL)

Table 1: Comparison of ESC/EAS 2016 vs 2019 guidelines[1]

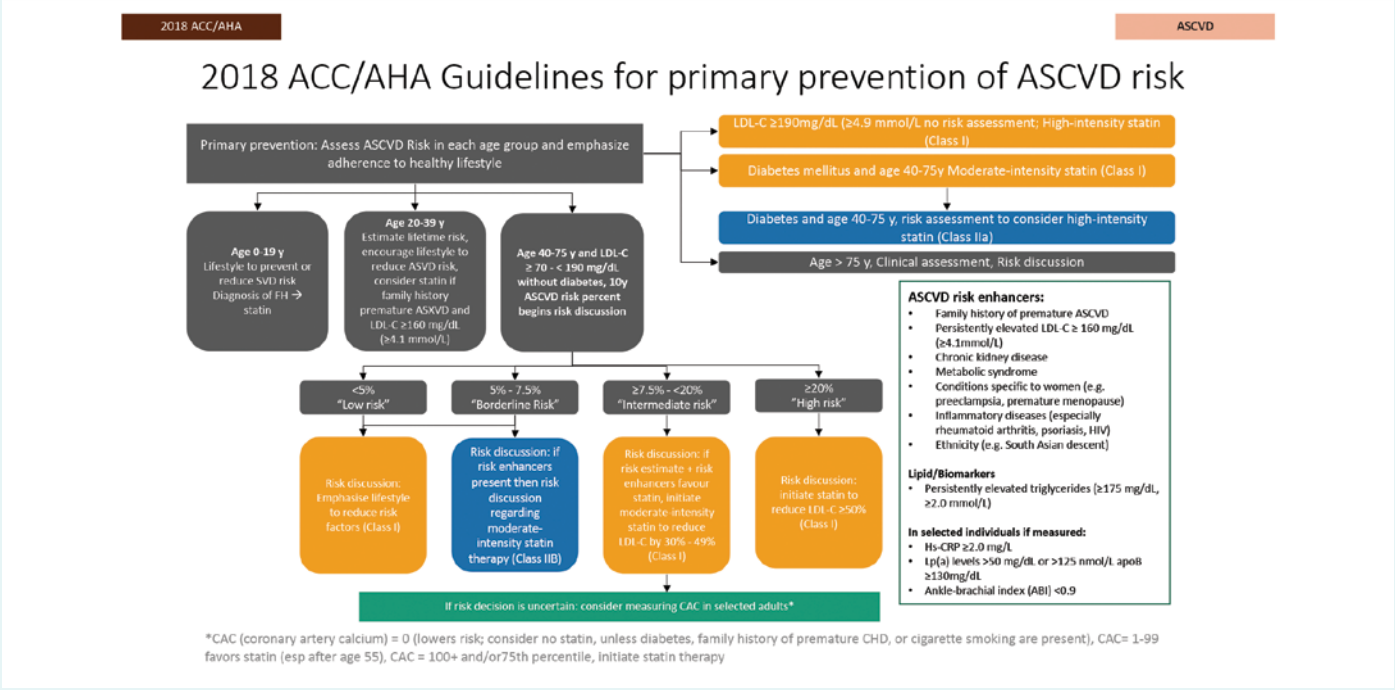


Table 2: 2018 ACC/AHA Guidelines for primary prevention of ASCVD risk[2]

The ACC and AHA 2018 guidelines recommend risk stratification amongst primary prevention cohorts (see Table 2), and commencement of statins to reduce LDL-C by 30% to ≥49% in intermediate risk and ≥50% in high risk. In secondary prevention cohorts, the 2018 guidelines recommend targeting a reduction in LDL-C of 50% and if LDL-C is still ≥70mg/dL to consider adding ezetimibe in high-risk patients. For very high risk patients, upfront high intensity or maximal tolerated statins should be commenced and if LDL-C is still ≥70mg/dL on top of ezetimibe, proprotein convertase subtilisin/kexin type 9 (PCSK9) inhibitors should be considered.

Lipid Treatment Options

The backbone of lipid lowering therapy remains statins. The general observation holds that high intensity statins lower LDL-C by a median of 50%, and moderate intensity statins lower LDL-C by a median of 30%.

With the publication of IMPROVE-IT[3], Fourier[4] and Odyssey[5] Trials, the use of non-statin therapy with proven cardiovascular benefit on top of maximal tolerated statin has been established and written into management guidelines.

Ezetimibe should be considered as an adjunct therapy for high to very high risk patients who do not reach LDL-C goals on high intensity or maximal tolerated statin therapy. The addition of PCSK9 inhibitors should be considered in the highest risk category if even an addition of ezetimibe does not achieve goals. The ESC/EAS 2019 guidelines further recommend that in statin-intolerant patients, PCSK9 inhibitors may also be considered on top of ezetimibe.

Treatment Practicalities

With established LDL-C targets to achieve, physicians now have clearer treatment goals as opposed to previous "fire and forget" advice from older guidelines.

It is relatively more straightforward to identify the high risk and very high risk cohorts by virtue of their co-morbidities and medical history. The difficulty with these cohorts is achieving stringent LDL-C targets which many doubt can be achieved by oral therapy alone, despite literature suggesting that Asians achieve LDL-C goals with lower doses of statins. Certainly, the threshold to add non-statin therapy like ezetimibe PCSK9 inhibitors on top of maximal tolerated statin therapy must now be lower, with increased physician awareness of its additional cardiovascular benefit in these cohorts. Having said that, significant challenge remains for initiating PCSK9 inhibitor therapy due to the injection administration and medication costs.

The initiation of lipid lowering therapy in the primary prevention cohort remains one that is more nuanced, and requires clinical judgement and perhaps adjunct investigations. The risk scores (ASCVD and the systematic coronary risk evaluation) applied in the guidelines may not be generalised across Asian cohorts, but an understanding of risk enhancers and tools such as the coronary artery calcium score per the ACC and AHA 2018 guidelines (see Table 2) is useful for further risk stratification and individualisation of LDL-C goals, and sets the stage for meaningful discussion with the patient on risks and benefits of treatment.

KEY TAKEAWAYS

Given the multitude of lipid lowering drugs (both statin and non-statin) with proven cardiovascular benefit, medical professionals must consistently identify patients who will benefit most from intensive upfront treatment and maximal therapy, and commence treatment expediently. With a modern armamentarium of risk stratification tools such as coronary artery calcium scores, ankle-brachial index and other biochemical markers, medical professionals should seek more objective and precise measures of individual cardiovascular risk to decide on lipid lowering therapy and thresholds in the primary prevention of the disease.

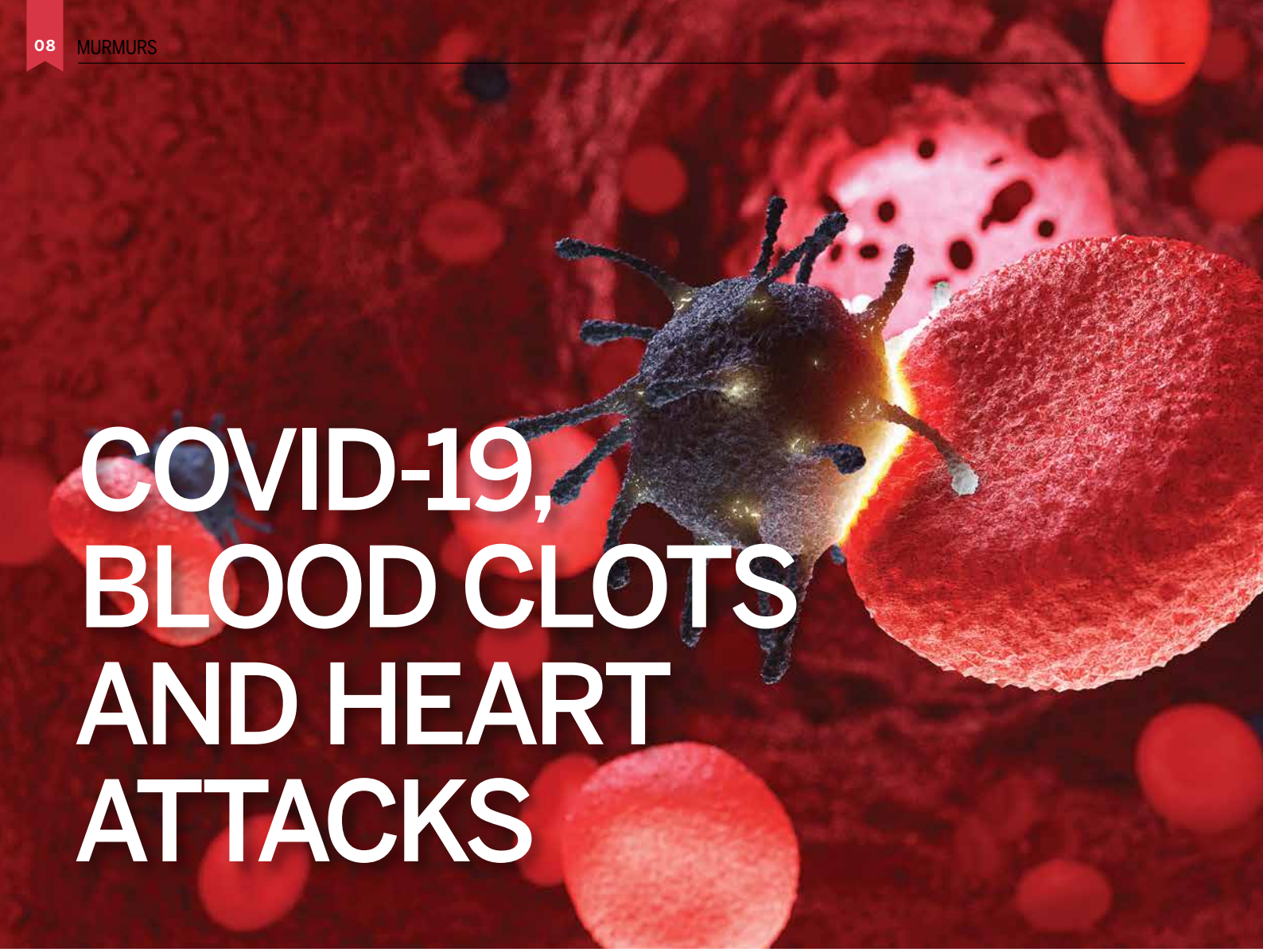
[1] 2019 Guidelines for the management of Dyslipidaemias: lipid modification to reduce cardiovascular risk: The Task Force for the management of dyslipidaemias of the European Society of Cardiology (ESC) and European Atherosclerosis Society (EAS). Eur Heart J 2019

[2] 2018 Guideline on the Management of Blood Cholesterol: A Report of the American College of Cardiology Foundation/ American Heart Association Task Force on Clinical Practice Guidelines. JACC 2018

[3] IMProved Reduction of Outcomes: Vytorin Efficacy International Trial – IMPROVE-IT. The New England Journal of Medicine 2015

[4] Further Cardiovascular Outcomes Research With PCSK9 Inhibition in Subjects With Elevated Risk – FOURIER. Am Heart J 2016

[5] Effect of alirocumab, a monoclonal antibody to PCSK9, on long-term cardiovascular outcomes following acute coronary syndromes: rationale and design of the ODYSSEY Outcomes trial. Am Heart J 2014



COVID-19, BLOOD CLOTS AND HEART ATTACKS

The Covid-19 pandemic has caused an upheaval in healthcare systems and brought on an unprecedented number of infected cases and deaths worldwide since it was first discovered.

A study[1] which looked at the impact of Covid-19 on heart health, has shown that a staggering three quarters of recovered Covid-19 patients suffered from heart inflammation, impairing the ability of the heart to contract, causing scar formation as well as resulting in an enlarged heart. Emerging reports have also suggested that infected patients experience higher risks of blood clot formation and heart disease – but just how much of this is fact?

Covid-19 and cardiovascular events

"Internationally, there have been reports that the SARS-COV-2 virus that causes Covid-19 infection can cause increased association with blood clots, heart disease and stroke, with the mechanism postulated as venous or arterial thrombosis either in situ or emboli from the heart," said Assoc Prof Jack Tan, Deputy Head and Senior Consultant, Department of Cardiology, NHCS.

The silver lining is that among local cases, only about 1 in 1000 experienced cardiovascular events[2]. However, Assoc Prof Tan warned that the frequency of blood clots is highest in patients requiring intensive care and that can cause complications like heart attack, stroke and pulmonary embolism - clots in the venous system that can travel to the lungs.

He added that older patients, smokers and those with underlying cardiac risk factors, or existing heart and lung issues, tend to be worse off, "If this group of patients becomes critically ill and requires ventilation support, multi-organ failure can ensue. When all these stressors come together, it is not surprising that a heart attack or stroke can be precipitated."

Can the common flu cause clots and heart attack?

"During each influenza season, we do see critically ill patients presenting with bad pneumonia, whether primarily from the influenza virus or from a superimposed secondary infection. They can be as sick as some of the Covid-19 patients and eventually pass on," shared Assoc Prof Tan.

Indeed, a study published in the European Respiratory Journal[3] showed

HEALTH TIPS

KEEP YOU AND YOUR HEART SAFE DURING THIS PERIOD:

Practise social distancing

Maintain an active and healthy lifestyle

Take your medications as instructed by doctors to control your risk factors, e.g. hypertension drugs

Seek medical attention if you experience any cardiac symptoms such as chest pain

that several different organisms that cause respiratory infections – including influenza and the bacteria responsible for pneumonia, increase heart attack and stroke risks. Researchers of the study found that the risk of heart attack and stroke occurring after a respiratory infection is generally low in young, healthy individuals. The same cannot be said for those over 65 years and/or with pre-existing heart diseases.

"We advise the at-risk group of individuals to get vaccinated against influenza. Sometimes, the seemingly common flu virus can also directly affect our heart muscles without causing a heart attack," cautioned Assoc Prof Tan. The condition, known as myocarditis, is an inflammation of the heart muscles, thereby reducing the heart's ability to pump, causing heart failure and abnormal heart rhythms.

Regular monitoring for at-risk Covid-19 patients

"We noted that the moment at-risk patients start feeling breathless while exerting minimally, the oxygen levels in their blood can drop drastically and the disease often progresses rather quickly," Assoc Prof Tan emphasised that elderly and those with underlying heart conditions, are especially susceptible.

Currently, the best standard of care is early diagnosis and monitoring of at-risk patients. Early step up for the level of care for oxygen support, prevention of secondary infection and complications while waiting for the body to recover is still the gold standard of care.

A few medications have been tried and most have proven not to be effective against the SAR-COV-2 virus. The antiviral drug remdesivir and the steroidal drug dexamethasone can have some positive effects in sicker patients but do not cure the infection. The world is still waiting for the first proven vaccine against COVID-19 infections.

Prevention is best

The coronavirus has, in most cases so far, caused a mild respiratory response and a latent infectious asymptomatic period in the majority of patients.

For the vulnerable group which tends to fare worse, in particular the elderly, those with chronic conditions like hypertension, coronary artery disease and diabetes. Assoc Prof Tan advised all to adhere to current safe distancing measures and do their part to reduce infections in the community.

[1] Outcomes of Cardiovascular Magnetic Resonance Imaging in Patients Recently Recovered From Coronavirus Disease 2019 (COVID-19): https://jamanetwork.com/journals/jamacardiology/fullarticle/2768916

[2] Extracted from MOH statement dated 4 June 2020: https://www.moh.gov.sg/news-highlights/details/covid-19-patients-with-blood-clots-and-heart-disease

[3] Laboratory-confirmed respiratory infections as triggers for acute myocardial infarction and stroke: a self-controlled case series analysis of national linked datasets from Scotland: https://erj.ersjournals.com/content/51/3/1701794

ARRESTING HEART DISEASE IN DIABETICS

Researchers from NHCS recently launched a multi-national clinical trial - Asian Diabetes Outcome Prevention Trial (ADOPT) to help prevent heart disease among high risk diabetic patients across Asia.

Singapore declared 'War on diabetes' in 2016 to combat the alarming rise in diabetes. In Singapore, the number of adults with diabetes is projected to increase from 440,000 to 1 million in less than 30 years. Diabetes accelerates the development of heart disease by as much as 14 years earlier, compared to those without diabetes. When a patient with diabetes is further burdened with heart failure, it leads to reduced quality of life, disability, hospitalisation, poor clinical outcome and poses tremendous burden in the healthcare expenditure. Treating patients with diabetes and cardiovascular complications is 112% higher in cost than treating diabetic patients without complications.

Research on Lean Diabetes among Asian Heart Failure Patients

Recent research by NHCS has discovered a unique 'lean diabetes' pattern in Asian patients with heart failure. These individuals develop diabetes despite a low body mass index (BMI), strikingly different from the conventional obesity-induced diabetes among Caucasians. The team found that these lean diabetic patients with heart failure were at high risk of hospitalisation and death. Particularly, even when their BMI was low, patients with large waist-to-height ratios were at the highest risk of poor outcomes. The landmark findings were published in several high impact scientific journals[1-2].

"Realising the dismal prognosis of lean diabetic patients with heart failure and the lack of proven therapies to improve their prognosis, the research team firmly believes that prevention of future cardiac disease among high-risk diabetic asymptomatic individuals is critical," explained Professor Carolyn Lam, Senior Consultant from Department of Cardiology, and Director of Women's Heart Health at NHCS.

Launch of Clinical Trial to Prevent Heart Disease in Diabetics

ADOPT aims to test if an intensive treatment strategy can reduce the onset of cardiovascular disease including stroke among high risk individuals with diabetes, compared to standard care. Specifically, ADOPT aims to

1. strategically identify diabetic individuals with high risk of heart disease using a biomarker – N-terminal pro-B-type natriuretic peptide (NT-proBNP); and

2. intensify preventive therapy using three established classes of commonly available medications which target blood pressure and blood sugar for primary prevention of cardiovascular (heart or blood vessel) events in these high-risk diabetic patients.

"In Singapore, the cost of treating diabetes is expected to rise to S$2.5 billion by 2050[3], given the current standard of care. Managing cardiovascular complications substantially adds to the direct costs of treating diabetes. If proven effective, this treatment regime could also potentially help save significant healthcare cost in Singapore and beyond," expressed Dr Chanchal Chandramouli, Research Fellow from National Heart Research Institute Singapore (NHRIS), who is also a key co-investigator and Steering Committee Member of ADOPT.

The ADOPT study will be conducted in 30 centres across six Asian regions including Singapore, Malaysia, China, Taiwan, India and United Arab Emirates. The team aims to recruit 2,400 volunteers with follow-up over a duration of four years. The team has recruited the first patient in late August, at Changi General Hospital – one of the ADOPT sites in Singapore.

This investigator-initiated trial has received support from the National Medical Research Council of Singapore, philanthropic and commercial partners.

[1] Chandramouli C, Tay WT, Bamadhaj NS, et al. Association of obesity with heart failure outcomes in 11 Asian regions: A cohort study. PLoS Med. 2019;16(9):e1002916. Published 2019 Sep 24. doi:10.1371/journal.pmed.1002916

[2] Tromp J, Tay WT, Ouwerkerk W, et al. Multimorbidity in patients with heart failure from 11 Asian regions: A prospective cohort study using the ASIAN-HF registry [published correction appears in PLoS Med. 2018 May 25;15(5):e1002583]. PLoS Med. 2018;15(3):e1002541. Published 2018 Mar 27. doi:10.1371/journal.pmed.1002541

[3] Khalik, S. (2016). Study: Cost of diabetes to Singapore to soar beyond $2.5b. The Straits Times.

DO YOU HAVE TYPE 2 DIABETES?

Join the clinical research study, Asian Diabetes Outcome Prevention Trial (ADOPT), to test if active prevention therapy may be associated with reduced cardiovascular disease compared to standard of care.

You are a potential patient for this study if you:

- **are ≥ 40 years of age**
- **have had Type 2 diabetes for at least six months**
- **have no known cardiovascular disease**

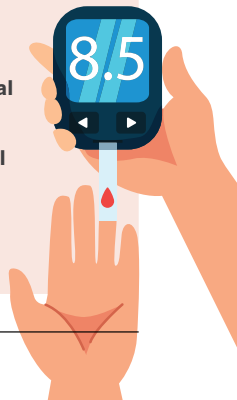
If you fulfill the above requirements and are interested to participate or find out more about the ADOPT study, please contact any of our Clinical Research Coordinators (Operating Hours: 8.30am to 5.30 pm, Monday to Friday) below:

Changi General Hospital
Tel: 6850 1994

National University Hospital
Tel: 6601 5950

Singapore General Hospital
Tel: 9187 2498

Tan Tock Seng Hospital
Tel: 6357 3046



RESEARCH PUBLICATIONS

April 2020 – August 2020

APRIL 2020

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