



Diagnostic tools and management of cardiovascular disease have seen remarkable advances.

New developments in cardiology

Did you know?

7.4 m.

The number of deaths due to coronary artery disease worldwide in 2012 according to WHO statistics

Over the last three decades the diagnostic tools and management of cardiovascular disease have seen remarkable advances. Echocardiograms and CT scans for the diagnosis of cardiovascular disease have been widely used to reduce the risk and cost associated with invasive procedures. Percutaneous coronary intervention (PCI) has replaced most coronary artery bypass graft surgeries (CABG) for the treatment of coronary artery disease.

New developments in cardiovascular examination tools

Treadmill tests, echocardiograms, nuclear scans, cardiac catheterisation and coronary angiography for the diagnosis of cardiovascular diseases have been available in the market for a long time.

However, the accuracy of traditional non-invasive tests, such as the treadmill ECG, exercise echocardiogram and thallium heart scan for detection of coronary artery disease, is relatively low (around 70-85%).^{1 2 3}

The advancement of medical technology has brought a considerable improvement in non-invasive cardiac examination tools including multidetector computed tomography (MDCT) and electron beam computerised tomography (EBCT), which have been widely used for detection of coronary artery stenosis. These tests provide excellent sensitivity and specificity in the diagnosis of plaque formation and stenosis in coronary vessels, restenosis of the coronary arteries after coronary artery bypass grafts or angioplasty with stents and in prediction of the heart attack risk. They are also good for the diagnosis of myocardial scarring caused by infarction, pericardial effusion and abnormalities of the pulmonary artery and aorta.

MDCT only takes 5-10 minutes to complete using advanced scanners. Intravenous contrast dye is needed for the CT heart study, although side effects from the dye are minimal and accuracy for the diagnosis of coronary artery disease is above 90%. Although coronary angiography is more accurate (>99%), it is an invasive test with greater potential

¹ Banerjee A, et al.: Diagnostic accuracy of exercise stress testing for coronary artery disease: a systematic review and meta-analysis of prospective studies

² McLellan A, et al.: Cardiac stress testing: Stress electrocardiography and stress echocardiography. Volume 41, No.3, March 2012

³ Suratkal V, et al.: Treadmill ECG test combined with myocardial perfusion imaging for evaluation of coronary artery disease: analysis of 340 cases

risk. However, MDCT is not a substitute for traditional coronary angiography in deciding whether coronary artery bypass surgery or percutaneous coronary intervention is needed for the patient with coronary artery disease. This is because MDCT is unable to detect smaller coronary artery stenoses.

New developments in the treatment of cardiovascular disease

Percutaneous coronary intervention

Open heart surgery for heart valve disease and coronary artery disease have been proven to improve the quality of life and to prolong life expectancy in some groups. The restenosis rate after coronary artery bypass graft surgery is 15% to 25% within one year of the operation.⁴ Teixeira et al. reported that patients develop acute coronary syndrome after CABG surgery in a median of 4 to 12.5 years due to new plaque formation, progression beyond the bypass graft anastomosis or disease development in the graft vessel. Percutaneous coronary intervention was introduced into the market in the 1980s. Although atherectomy, laser, rotablator and brachytherapy procedures are also available, angioplasty plus stenting is still the most popular treatment for coronary artery stenosis. In up to 50% of cases, restenosis occurs within 6 months of PCI with balloon angioplasty alone. Angioplasty plus bare metal stents (BMS) reduced the chance of restenosis to 25% and the use of drug-eluting stents (DES) further reduced the risk to less than 10%.^{5,6} Several different kinds of stents are now available in the market:

Drug-eluting stents: A DES is coated with medicine which is slowly released to inhibit cell proliferation and prevent scar tissue from growing into the artery. The mechanism of action of DES is to promote endothelial growth so that the artery can heal faster to prevent in-stent restenosis. This is the most common type of stent used in percutaneous coronary intervention nowadays.

Bioabsorbable stents: Most angiographic restenosis after balloon angioplasty occurs between 1 to 3 months and is rare thereafter. Bioabsorbable stents can be used to prevent restenosis at the early stage of implantation and will then disappear automatically afterward. The advantages of a bioabsorbable stent include easier repetition of surgical or percutaneous treatment at the same site, the ability to regain vasomotion of the artery, avoidance of side-branch obstruction by struts or strut fracture and improvement of the lesion imaging with CT and MRI scans. This type of stent is especially good for paediatric patients because it allows vessel growth without surgical removal of the device.⁷

Endothelial progenitor cell capture stents: This stent is coated with CD34+ to attract endothelial progenitor cells. The purpose is to promote endothelial growth and speed up healing in the artery with the prevention of restenosis.⁸

Percutaneous valve replacement

With the life span of people in developed countries getting longer, the need for less invasive and safer methods for the treatment of heart valve disease is increasing. Balloon valvuloplasty for both mitral stenosis and pulmonary stenosis has been proven to be effective and is commonly used nowadays. Percutaneous valve replacement for mitral and aortic valve disease is undergoing phase 1 to 2 trials. It is expected that percutaneous intervention for valvular disease will be as common as percutaneous coronary intervention in the future.⁹

Autologous stem cell therapy

In autologous stem cell therapy the procedure involves collecting peripheral blood from the patient. Progenitor endothelial cells (CD34+) are first isolated and then injected back into the patient by intravenous or intra-coronary routes. This treatment has been used in patients with ischemic heart disease, ischemic strokes, dilated cardiomyopathy, congestive heart failure and peripheral artery disease. Studies have shown improvement in these diseases in some cases. This treatment is still at an experimental stage but it could prove to be a potential

⁴ O'Riordan M: CABG Reduces Risk of Death vs PCI in Diabetic Patients

⁵ Gunn J, et al.: Deferral vs. performance of percutaneous coronary intervention of functionally non-significant coronary stenosis: 15-year follow-up of the DEFER trial.

⁶ Verma S, et al.: Comparison of coronary artery bypass surgery and percutaneous coronary intervention in patients with diabetes: A meta-analysis of randomized controlled trials. *Lancet Diabetes Endocrinol.* 2013

⁷ Kern M: Bioabsorbable stents – Where are we now? *Cath Lab Digest*, Issue Number: Volume 20 - Issue 6 - June 2012

⁸ Leopold JA: Prohealing endothelial progenitor cell capture stents, do the cells captured explain the clinical outcomes?

⁹ Satpathy R, et al.: Percutaneous Valve Replacement.

therapy for chronic heart failure and dilated cardiomyopathy through improvement in left ventricular function (e.g. left ventricular ejection fraction, contractility), increased oxygen uptake, augmented exercise capacity and a decrease in long-term mortality.^{10 11 12}

New drugs

There are quite a lot of new drugs available for the treatment of cardiovascular disease. Ivabridine and Ranolazine have been proven to be highly effective for angina pectoris.¹³ New anticoagulant medications with less risk of haemorrhage, e.g. Dabigatran Etxilate, are now available for the prevention of thrombosis after percutaneous coronary intervention or artificial valve replacement.¹⁴ Dronedarone is better for the treatment of atrial fibrillation compared with the existing antiarrhythmic drugs.¹⁵ Nefrilysin is a new medication which is effective for the treatment of heart failure.¹⁶ A statin called Rosuvastatin calcium can lower the LDL cholesterol and has now been approved by the U.S. Food and Drug Administration for prevention of coronary artery disease and stroke in individuals who have no clinical evidence of cardiovascular disease but who are at an increased risk because of older age, an elevated high-sensitivity C-reactive protein level (> 2 mg/L) and the presence of additional cardiovascular risk factors such as hypertension, smoking or low HDL-C.¹⁷

New technology

Robotically assisted cardiac surgery for coronary artery bypass, valvuloplasty and valvular replacement has been successfully applied to patients in the last few years.¹⁸ The incisions used in robotic surgery are smaller compared with

traditional minimally invasive surgery. The patient can recover earlier with less pain and a shorter stay in the hospital. It is expected more cardiac surgery will be performed using robotic technology.

Wireless defibrillators that are placed subcutaneously like a regular pacemaker without traditional wires going into the heart are now available in the market. This is good for the prevention of infection or malfunction of the defibrillator.

Wearable trackers can monitor physical activity and smart watches can deliver medical-grade ECG tracings to monitor arrhythmias. Both are widely available and welcomed by doctors and patients alike.

Impact on insurance products

The incidence rate of heart attack is expected to drop due to the early diagnosis and early treatment of coronary artery disease. The use of percutaneous intervention for coronary artery disease and valvular heart disease will increase. Most coronary artery bypass graft surgery will be replaced by percutaneous intervention.

Life spans will be further improved by the development of advanced medications and other medical technology.

Consequently, insurance pricing must be re-evaluated from time to time and studies should be conducted regularly to review the impact of modern medical procedures on the morbidity and mortality risk.

¹⁰ Strauer BE, et al.: The acute and long-term effects of intracoronary stem cell transplantation in 191 patients with chronic heart failure: The STAR-heart study Eur J Heart Fail (2010)

¹¹ Oettgen P: Cardiac stem cell therapy, need for optimization of efficacy and safety monitoring, Circulation. 2006

¹² Perin EC. Stem cell therapy for cardiovascular disease, Tex Heart Inst J. 2006

¹³ Villano A, et al.: Effects of ivabradine and ranolazine in patients with microvascular angina pectoris

¹⁴ Hankey GJ, et al.: Dabigatran etexilate: A new oral thrombin inhibitor. Circulation. 2011 Apr 5

¹⁵ Passman R, et al.: Clinical uses of dronedarone, uptodate.

¹⁶ Vardeny O: Angiotensin Receptor-Nefrilysin Inhibitors in Heart Failure: A shifting paradigm, Evid Based Med. 2015

¹⁷ Questions and Answers for Healthcare Professionals: CRESTOR and the JUPITER Trial

¹⁸ Chitwood, Jr. WR, MD: Robotic Cardiac Surgery by 2031. Tex Heart Inst J. 2011



Dr. Raymond Luk
Medical Director
Tel. +852 2117 4030
raymond.luk@hannover-re.com

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