

Imaging breakthrough sheds more light on coronary artery disease



Dr. Adam Leung
Specialist in Cardiology

A breakthrough in technology has put a superior imaging tool into the hands of interventional cardiologists.

For more than 20 years cardiologists have used percutaneous coronary intervention (PCI) - or the commonly-called coronary angioplasty and stenting - to treat severe obstructive coronary artery disease.

A PCI involves widening arteries that have become clogged with fat by using an inflated balloon-type instrument and propping open the artery with a small tube called a stent.

This procedure is often carried out with the help of intravascular ultrasound (IVUS), which gives the cardiologist a cross-sectional image of the section of diseased artery.

These scans are invaluable in providing information on vessel dimension, plaque area, and important characteristics during stent implantation. Studies have also shown they improve the outcome of the procedure.

One minor setback is the limited resolution (100 – 150 μm) of IVUS, which is often too low to detect fine details such as intimal (membrane) tears, thrombus (blood clots), inadequately expanded (malapposition) stents, and tissue prolapse during stenting.

However, a technological breakthrough called optical coherence tomography (OCT) has heralded the era of high-definition into intracoronary ultrasound, bringing with it a tool which can more accurately diagnose and treat artery disease.

Coronary OCT consists of a thin and flexible catheter with a built-in fibre-optic wire that emits light in the near infrared spectrum (1250–1350 nm) and records reflected light signals to produce images. This wire is rotated while simultaneously being pulled along the coronary artery.

Hong Kong Adventist Hospital is the first private hospital in Hong Kong to offer this novel technology at its Cardiac Catheterization and Intervention Centre.

For the cardiologist, OCT has several advantages over traditional scans. Of these, the most obvious is its higher resolution imagery, which at 4 to 20 μm is about ten times greater than that of ultrasound scans. This provides cardiologists with a much clearer picture and more precise measurements of the area inside the blood vessels.

In addition, by analysing information from the reflected light, OCT can display the fine composition of the damaged tissue and identify the so-called thin cap fibro-atheroma, a plaque which can lead to the formation of blood clots that cause acute heart attack or unstable angina.

Identifying these vulnerable plaques – a lipid-rich plaque with a thin fibrous cap - can help the cardiologist make decisions during a PCI procedure.

Secondly, this high resolution captures micro-structural features such as intimal tears, thrombus, and tissue prolapse both before and after PCI.

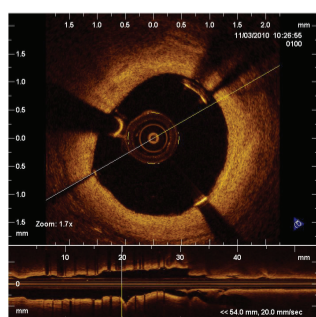
It is also useful in ensuring stents are expanded correctly; a useful tool given that malapposed stents are a proven major predictor of restenosis and late stent thrombosis. This means, the use of OCT has the potential to improve the efficiency of stenting.

OCT can also be used for assessing normal and borderline coronary artery stenosis – or the narrowing of the arteries - while its superior imaging makes it particularly useful in identifying blood clots.

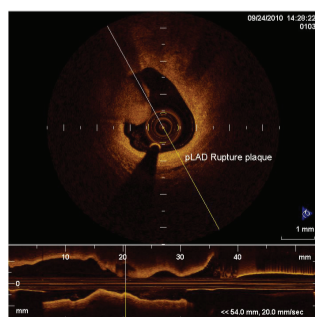
It is also useful in the assessment of vascular healing following drug-eluting stenting, which uses stents coated with drugs to help prevent the arteries from narrowing again. Inadequate stent coverage is believed to be a possible cause of stent thrombosis that can occur months after the procedure.

Finally, OCT is fast and easy to use. The catheter is thin and flexible and can be delivered using conventional angioplasty guidewires. It takes just three seconds to perform a complete imaging scan with images being available immediately to review.

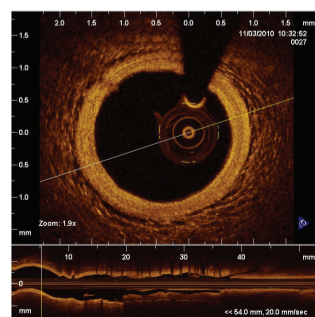
All these advantages make OCT technology a welcome addition to the tools used by cardiologists in the diagnosis and treatment of coronary artery disease. There is little doubt about its potential to improve the short-term results and the long-term safety of PCI.



Stent Malapposition



Plaque Prolapse



Normal 3 layers