New developments in coronary stent technology

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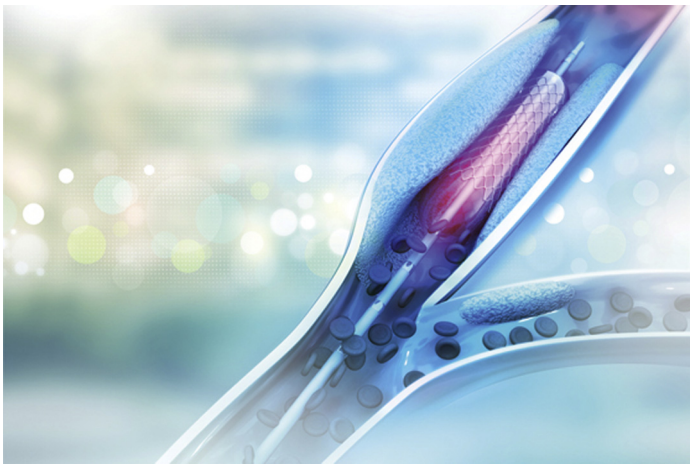
Current performance standards are high and promising new technologies are finding it difficult to compete



The narrative review in this issue of the *MJA* by Chen and Jepson[1] outlines the enormous advances made in stent technology since Sigwart and colleagues published the first report on the clinical use of coronary stents in 1987.[2] Driven by technological progress and rigorous scientific study, coronary stents have advanced rapidly to the stage where a patient's coronary stenosis can be safely and reliably opened.

A 60-year-old man is brought to the emergency department with severe chest pain, his electrocardiogram showing marked anterior ST elevation. He has a ventricular fibrillation arrest and is shocked into sinus rhythm. Catheterisation laboratory staff are on their way and, within minutes of arrival, a coronary angiogram shows complete occlusion of the left anterior descending artery. A guide-wire is inserted and flow is established after balloon inflation. His pain is settling as a drug-eluting stent is inserted. He is discharged on Day 3.

Despite benefiting dramatically from stent technology, our patient's future is not without risks and challenges. He needs to take dual antiplatelet drugs for 1 year and postpone elective surgery. Over the next 5 years, he faces a stent thrombosis rate of 1.4–4.0%, and an almost 20% chance of adverse events including death, myocardial infarction (MI) or repeat procedures.[3-5] As Chen and Jepson point out in their review, there appears to be an ongoing risk of ischaemic events for some years after successful stent implantation. The cause of this is likely a combination of stent factors including chronic inflammation, uncovered struts and neoatherosclerosis within the stent, as well as progression of atherosclerotic disease elsewhere. In a long term follow-up of patients treated with second generation stents, around 50% of adverse events were not related to the stent but were due to plaque progression at other coronary sites.[6] This emphasises the importance of secondary prevention strategies for the long term health and wellbeing of patients treated with stents.

Progress in stent technology has made percutaneous coronary intervention (PCI) a relatively easy and safe procedure with visually impressive results for doctors and patients. Greater adoption of radial artery access has also contributed to the added safety of these procedures.[7] It can be difficult to resist the temptation to insert stents in order to obtain aesthetically satisfying results in imperfect coronary arteries. Yet there is evidence from a randomised trial to suggest that PCI in patients with stable coronary disease does not reduce the risk of death, MI or other major cardiovascular events compared with optimal medical treatment.[8] The challenge for physicians is not how to place a stent, but deciding when to intervene to produce the best outcomes for patients in a cost-effective way. Assessment of patients for evidence of ischaemia and use of fractional flow reserve measurement in coronary arteries should have a larger influence in decision making than reliance on visual assessment of coronary arteries at the time of angiography.

We also need to better understand the disease that we are treating. It is simplistic to think that stent insertion will remain the optimal treatment for all forms of coronary disease such as thin-cap plaque rupture, fibrous plaque, calcified plaque, thrombus, erosions, spontaneous dissection, long lesions, chronic total occlusions, bifurcation lesions and restenosis. Greater use of intracoronary imaging before and after stent insertion can help us to better diagnose the nature of coronary stenosis, with the future prospect of optimising treatment for individual patients.

Current generation drug-eluting stents have set such a high standard in safety and efficacy for such a wide range of lesions that new technologies will find it difficult to show superiority without large and long term clinical trials. Bioresorbable vascular scaffolds are an example of a very promising technology that is finding it difficult to compete with second generation stents in a wide range of lesion types. Bifurcation stents are another promising advance, but a recent randomised trial showed that a dedicated bifurcation stent was associated with a higher risk of MI compared with a conservative one-stent strategy.[9]

The success of stent technology has made PCI one of the most commonly performed procedures in medicine today and we look forward to further developments in this field. Yet, ironically, we would also welcome future reports of a decline in stent insertion in Australia, as this would indicate that as a society, we are starting to win the battle against coronary artery disease. With the rising tide of obesity and diabetes, this appears unlikely in the foreseeable future.

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