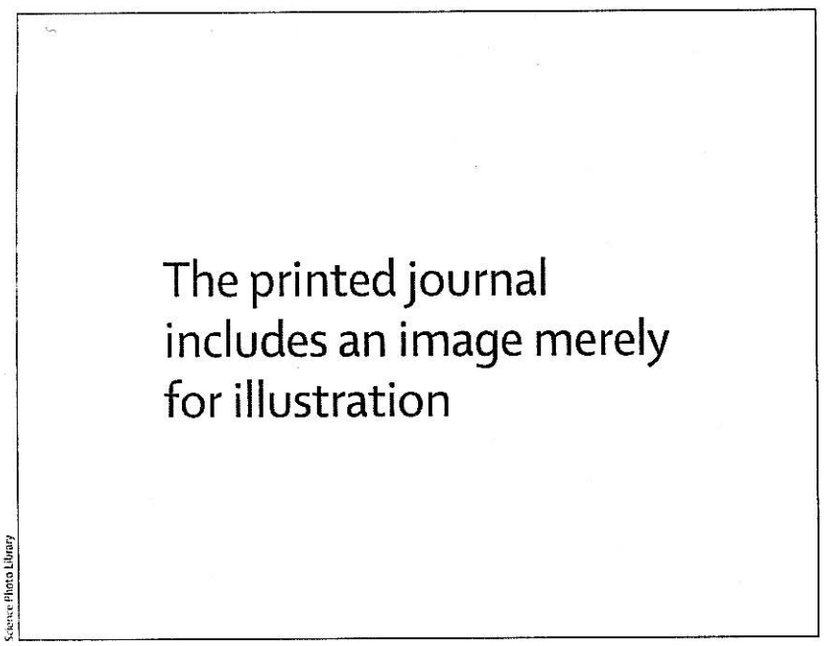
# Absorbable coronary stents

The concept of percutaneous coronary intervention with bioabsorbable stents has created interest because the need for stenting is temporary, and beyond the first few months there are disadvantages of a permanent implant. Conventional stents limit restenosis by holding back intimal flaps that have separated from deeper layers, and by preventing vessel recoil. The excessive healing response to stenting that contributes to restenosis could be abolished by coating stents with antiproliferative drugs. However, late-stent thrombosis sometimes occurs, probably because such drugs hinder the healing process that covers stent struts with endothelial cells.[1,2]

Potential advantages of having the stent disappear from the treated site include reduced late-stent thrombosis, since, if the struts disappear, these foreign bodies would not be exposed to the blood. Stent absorption might facilitate repeat treatments to the same site, allow restoration of vasomotion, and allow improved lesion imaging with MRI and CT. Some less common, but troublesome, complications of current stent technology, such as stent-strut fracture and a delayed allergy to polymer,[3] might become less likely or cause fewer ongoing problems. Additionally, if the artery is not splinted, lumen size might later improve (positive remodelling).[4] Many patients would prefer to have a stent that does its job and then disappears, rather than a permanent implant.

See Articles page 1869

In today's *Lancet*, Raimund Erbel and colleagues[5] report the first-in-human experience of temporary scaffolding of coronary arteries with bioabsorbable, but not drug-eluting, magnesium stents. At 12 months, the stents were safe, in that there was no stent thrombosis, myocardial infarction, or death in any of the 63 patients. However, angiographic restenosis developed in 47·5% of patients, and 27 (45%) of the 60 patients available at 12 months follow-up needed repeat revascularisation by 12 months. These rates are similar to, or higher than, those reported with balloon angioplasty alone.[6]




Science Photo Library

The renarrowing of the arterial lumen with the magnesium stent was in part due to negative remodelling (shrinking of the vessel) and partly due to an excessive healing response, with tissue growth into the stent. These mechanisms of restenosis are similar to those seen after balloon angioplasty.[7] The current magnesium stent might be absorbed too quickly (in weeks), so that the artery is not supported for long enough to prevent negative remodelling. If these problems are resolved by slower stent absorption, the excessive healing response could be limited by the controlled release from the stent of an antiproliferative drug.

The period for which an artery needs to be supported mechanically after percutaneous coronary intervention is unknown, but probably ranges from a few weeks to 6 months. After stent absorption, reaction of the artery might be similar to that after balloon angioplasty. We have shown[4] that between 1 and 5 years after balloon angioplasty, the vessel lumen at the treated site usually enlarges.

A promising non-metallic approach to absorbable stents is the BVS polylactic acid stent, which elutes the antiproliferative drug everolimus.[8] Initial results show that, after 9 months, safety was confirmed in all 30 patients, with no deaths or stent thromboses, only one non-Q wave myocardial infarction, and no ischaemia-driven target lesion revascularisations.[9] The restenosis rate (12%) was low. An improved stent design with more radial strength, better vessel coverage, and less recoil is to be assessed in an upcoming trial.

Bioabsorbable stents are in an early stage of development but hold considerable promise for overcoming many of the limitations of permanent metallic implants. Knowledge about how diseased human coronary arteries respond to bioabsorbable stents, such as magnesium stents, in the medium term and beyond is scarce. The initial patients treated with these devices will need to be followed up closely and for a long time. Whether bioabsorbable stents signal the threshold of a new era for percutaneous coronary intervention is yet to unfold.

*John Ormiston, Mark Webster*
Mercy Angiography and Auckland City Hospital, Auckland, New Zealand
johno@mercyangiography.co.nz

JO has received honoraria from Abbott Vascular, who make the BVS polylactic acid stent and he is the principal investigator of the first-in-human trial with this stent. MW declares that he has no conflict of interest.

1 Kotani J-I, Awata M, Nato S, et al. Incomplete neointimal coverage of sirolimus-eluting stents: angioscopic findings. *J Am Coll Cardiol* 2006; **47**: 2108–11.
2 Finn AV, Joner M, Nakazawa G, et al. Pathological correlates of late drug-eluting stent thrombosis: strut coverage as a marker of endothelialization. *Circulation* 2007; **115**: 2435–41.
3 Virmani R, Guagliumi G, Farb A, et al. Localized hypersensitivity and late coronary thrombosis secondary to a sirolimus-eluting stent: should we be cautious? *Circulation* 2004; **109**: 701–05.
4 Ormiston JA, Stewart FM, Roche AHG, Webber B, Whitlock RML, Webster MWI. Late regression of the dilated site after coronary angioplasty: a five year quantitative angiographic study. *Circulation* 1997; **96**: 468–74.
5 Erbel R, Di Mario C, Bartunek J, et al. Temporary scaffolding of coronary arteries with bioabsorbable magnesium stents: a prospective, non-randomised multicentre trial. *Lancet* 2007; **369**: 1869–75.
6 Serruys PW, de Jaegere P, Kiemeneij F, et al. A comparison of balloon-expandable-stent implantation with balloon angioplasty in patients with coronary artery disease. Benestent Study Group. *N Eng J Med* 1994; **331** (8): 489–95.
7 Mintz GS, Popma JJ, Pichard AD, et al. Arterial remodeling after coronary angioplasty. A serial intravascular ultrasound study. *Circulation* 1996; **94**: 35–43.
8 Ormiston JA, Webster MWI, Armstrong G. First-in-human implantation of a fully bioabsorbable drug-eluting stent: the BVS poly-L-lactic acid everolimus-eluting coronary stent. *Cathet Cardiovasc Interv* 2007; **69**: 128–31.
9 Dudek D. The ABSORB trial nine month results from the first-in-man evaluation of a fully bioabsorbable everolimus-eluting coronary stent. http://www.europcronline.com/diapos/EuroPCR2007/3788-140-23_20070522_17_55_Room1_Dudek_Dariusz_Speaker/Dariusz_Dudek_ABSORB_22May2007.pdf (accessed May 29, 2007).