



Horizon Scanning Technology Prioritising Summary

The Safe-Cross® Radiofrequency Total Occlusion Crossing System

September
2005



Australian
Safety
and Efficacy
Register
of New
Interventional
Procedures -
Surgical



Royal Australasian
College of Surgeons



© Commonwealth of Australia [2005]

This work is copyright. You may download, display, print and reproduce this material in unaltered form only (retaining this notice) for your personal, non-commercial use or use within your organisation. Apart from any use as permitted under the Copyright Act 1968, all other rights are reserved. Requests and inquiries concerning reproduction and rights should be addressed to Commonwealth Copyright Administration, Attorney General's Department, Robert Garran Offices, National Circuit, Canberra ACT 2600 or posted at <http://www.ag.gov.au/cca>

Electronic copies can be obtained from <http://www.horizonscanning.gov.au>

Enquiries about the content of the report should be directed to:

HealthPACT Secretariat
Department of Health and Ageing
MDP 106
GPO Box 9848
Canberra ACT 2606
AUSTRALIA

DISCLAIMER: This report is based on information available at the time of research and cannot be expected to cover any developments arising from subsequent improvements to health technologies. This report is based on a limited literature search and is not a definitive statement on the safety, effectiveness or cost-effectiveness of the health technology covered.

The Commonwealth does not guarantee the accuracy, currency or completeness of the information in this report. This report is not intended to be used as medical advice and it is not intended to be used to diagnose, treat, cure or prevent any disease, nor should it be used for therapeutic purposes or as a substitute for a health professional's advice. The Commonwealth does not accept any liability for any injury, loss or damage incurred by use of or reliance on the information.

The production of this Horizon scanning prioritising summary was overseen by the Health Policy Advisory Committee on Technology (HealthPACT), a sub-committee of the Medical Services Advisory Committee (MSAC). HealthPACT comprises representatives from health departments in all states and territories, the Australia and New Zealand governments; MSAC and ASERNIP-S. The Australian Health Ministers' Advisory Council (AHMAC) supports HealthPACT through funding.

This Horizon scanning prioritising summary was prepared by staff from the Australian safety and Efficacy Register of New Interventional Procedures – Surgical (ASERNIP-S).



Name of Technology:

The Safe-Cross® Radiofrequency (RF) Total Occlusion Crossing System (Intraluminal Therapeutics Inc.).

Purpose and Target Group:

The Safe-Cross® RF Total Occlusion Crossing System (Intraluminal Therapeutics, California) was designed to ablate total coronary occlusions (using radiofrequency energy) which could not be treated using conventional guidewires currently used in angioplasties.

Stage of Development (in Australia): not yet emerged in Australia

- Experimental
- Investigational
- Nearly established
- Established
- Established but changed indication or modification of technique
- Should be taken out of use

The Safe-Cross® System is not listed or registered in the Australian Register of Therapeutic Goods (ARTG).

International Utilisation:

COUNTRY	LEVEL OF USE		
	Trials underway	Limited use	Widely diffused
United States		✓	
Europe			✓

Impact Summary:

Background

Chronic total coronary artery occlusion is the complete obstruction of the vessel for at least one month (Sionis *et al.* 2003). The occlusion is typically made up of two tissue types, atheromatous plaque and old thrombus. Chronic total coronary artery occlusion patients suffer from angina, the most common forms being: angina on the first physical effort of the day, angina at the onset of physical exertion which improves although the activity is continued and diminished exercise tolerance which is often associated with silent ischemia. If an occlusion is left untreated, the patient may suffer from severe angina or ischemia, acute myocardial infarction and other potentially deadly cardiovascular diseases (eg. congestive heart failure, sudden cardiac arrest) (Singh 2005).



Percutaneous transluminal coronary angioplasty is the procedure used to recanalise the occluded artery. To date, successful recanalisation of chronic total coronary occlusions remains a challenge to interventional cardiologists although 28 years have passed since the first coronary angioplasty in 1977 (Sionis *et al.* 2004).

In balloon angioplasty, a balloon-tipped catheter uses a steerable guidewire which precedes the balloon into the artery. Once at the site of the blockage the guidewire is used to cross the plaque and the balloon is subsequently dilated, resulting in plaque compression and increased lumen diameter due to overstretching of the vessel wall, thus re-establishing normal blood flow. Stents are subsequently inserted into the artery to maintain luminal diameter (Burchenal *et al.* 2003). Despite various refinements to this technique there are specific limitations which can severely limit the success rate of recanalisation. In most cases, failure of this technique can be attributed to unsuccessful crossing of the guidewire and sometimes failure of balloon insertion through the plaque (Sionis *et al.* 2003). The reason for this is the fibrotic nature of long-term occlusions, capable of promptly halting the progression of conventional guidewires attempting to cross it. In view of this, low-friction and extra stiff guidewires have been developed to overcome this barrier. However these guidewires may fail if deflected or it may puncture the arterial wall due to its stiff construction (Baim *et al.* 2004). Success rates of conventional guidewires in treating chronic coronary occlusion ranges from 25% to 75%; depending on the characteristics of the occlusion and operator skills (Shammas, 2004).

Unlike other guidewires, the Safe-Cross® is able to deliver a train of ~3 short pulses of radiofrequency energy at one-second intervals. This radiofrequency energy can ablate the dense fibrotic occlusions, thus allowing the guidewire to cross the plaque for effective balloon dilation. Safe-Cross® also implements a new guidance system known as optical coherence reflectometry. This guidance system allows the operator to examine tissue $\leq 0.5\text{mm}$ ahead of the wire tip at a resolution of 0.01mm and will alert the operator if the wire gets too close to arterial tissue thus preventing perforation. Additionally, radiofrequency pulses can only be activated if the system does not detect the presence of arterial wall within 1mm ahead of the wire tip (Baim *et al.* 2004).

Clinical Need and Burden of Disease

Chronic total coronary occlusion accounts for 5% to 15% of all angioplasty procedures (Sionis *et al.* 2003). In 2001-2002, approximately 30,000 coronary angioplasty procedures were performed in Australia. This would mean that 1500 to 4500 Australians are treated for chronic total occlusions annually (using the estimate provided in Sionis *et al.* 2003). Of these, most would be successfully treated using conventional guidewires; hence the proportion of patients requiring the use of Safe-Cross® is lower than this estimate.



Estimated Speed, Geographic and Practitioner Use, Patterns of Diffusion in the Health System

The Safe-Cross® RF Total occlusion Crossing System was granted 510K approval from the FDA in January 2004 and is currently being used in the United States as a means of ablating plaque for guidewire crossing when initial attempts to cross with conventional guidewires have failed. The Safe-Cross® system was approved for use in Europe in 2002 (Baim et al. 2004). If approved by the TGA, the Safe-Cross® system is expected to readily diffuse into the Australian healthcare system.

Existing Comparators

Comparators for Safe-Cross® are guidewires with the ability to ablate/cut through chronic total coronary occlusions. Other treatment alternatives include open surgery if the angioplasty fails.

- Frontrunner-XR (LuMend Inc.) – undergoing clinical trials
- Crosser system (FlowCardia Inc.) - experimental
- Prima excimer laser wire (Spectranetics International)
- Rotablator (Boston Scientific)

Estimated Cost Impact

The cost of this device in Australia is not known. The total cost to the hospital (in the United States) is USD\$36,800 which includes the Safe-Cross® RF system, the Safe-Cross® console and the Safe-Cross® Display Screen. The estimated standardised charge per case ranges from USD\$14,440 to USD\$107,405 depending on the complexity and severity of each case (CMS 2004). The Medicare Benefits Schedule reimbursement for angioplasty of the coronary artery (Item number: 35304) and more than one coronary artery (Item number: 35305) is \$437.35 and \$560.70 respectively with 856 and 53 claims respectively (June 2004-June 2005). The reimbursement for transluminal stent insertion including associated balloon dilation for the coronary artery (Item number: 35310) is \$646.90 with 20373 claims between June 2004 to June 2005 (Medicare Australia 2005).

Efficacy and Safety Issues

List of Studies Found

Total number of studies	8
Case series studies	4
Case reports	4



The studies included in this summary are highlighted in bold in the reference list.

Safety and efficacy data from 3 case series studies have been selected for inclusion in this summary; these studies were selected based on patient numbers. The case series by Kirvaitis *et al.* (2004) was excluded due to the fact that Safe-Cross® was used to treat chronic occlusion in peripheral arteries instead of the coronary artery.

The Guided Radio Frequency Energy Ablation of Total occlusion (GREAT) Registry was a non-randomised, prospective, multicenter registry which enrolled 116 patients suffering from chronic total coronary occlusions (median known duration of occlusion = 22 months) where previous treatment with conventional guidewires have been unsuccessful. Safe-Cross® was successfully used to cross the occlusion in 54% (63/116 patients, confidence interval 44.8-63.6) of patients, a result which exceeded the pre-set objective performance criterion of 30% significantly ($p < 0.001$). Radiofrequency pulse was successfully used at least once (range 1-249) in 58 of the 63 patients. Ninety two percent (57/63 patients) had successful use of adjunctive conventional wires after the use of the Safe-Cross® guidewire (Baim *et al.* 2004).

In the study by Wong *et al.* (2004), only 43% (9/21 patients) of chronic coronary occlusion patients (occlusions have been present for a period of three months to ten years) were successfully treated with conventional guidewires. The procedure was re-attempted using Safe-Cross® and produced an 83% success rate in the remaining 12 patients who were unsuccessfully treated with conventional guidewires. This amounted to an overall 90% treatment success rate (19/21 patients) (Wong *et al.* 2004). However, Ng *et al.* (2003) reported a 60% success rate in crossing the obstruction using Safe-Cross®; the authors attributed the lower success rate to inexperience with the procedure.

No difference in success rates were reported when the Safe-Cross® guidewire was used in different vessel locations (54% in right coronary artery, 60% in left anterior descending artery), occlusion duration/age (51% > 1 year), occlusion length (47% > 30 mm), and morphology (58% blunt and 50% bridging collaterals) (Baim *et al.* 2004). Wong *et al.* (2004) reported some difficulty in steering the Safe-Cross® guidewire in one patient. In this case, the Safe-Cross® could not be steered around a vessel bend due to the relatively stiff and straight wire tip. This was addressed with the use of an angled catheter to replace the over-the-wire balloon catheter (Wong *et al.* 2004). Ng *et al.* (2003) provided further comments regarding the limited flexibility of the Safe-Cross® guidewire, stating that other conventional coronary guidewires were often implemented for redirection within the lesion and exchanged back to the Safe-Cross® for further progression using radiofrequency pulses.



Eight patients (8/116 patients) in the GREAT registry suffered at least one major adverse clinical event. In six patients, non-Q wave myocardial infarction (median creatine kinase-MB 32.4, range 9.1 to 119.3) was detected by post-procedural enzyme monitoring, 6.7% of patients experienced some degree of perforation but only three patients (2.6%) were deemed to have experienced clinically significant perforations, of these only one case was determined to be directly related to the Safe-Cross® guidewire (Baim *et al.* 2004). Both Wong *et al.* (2004) and Ng *et al.* (2003) reported no complications, adverse events or perforations in all patients.

Ethical Issues

No issues were identified from the retrieved material.

Cultural or Religious Considerations

No issues were identified from the retrieved material.

Other Issues

No issues were identified from the retrieved material.

Conclusion:

The evidence available on the safety and efficacy of Safe-Cross® is limited. However, its ability to cross vessels when conventional guidewires have failed to do so safely indicates that it may be a valuable technology, although no long-term data is available. The lack of comparative data with other new guidewires presents a problem in determining if Safe-Cross® provides significant advantages over other guidewires designed to cross fibrotic occlusions. Based on the available information, it is recommended that the following be conducted:

- | | |
|--|--|
| <input type="checkbox"/> Horizon Scanning Report | <input type="checkbox"/> Full Health Technology Assessment |
| <input checked="" type="checkbox"/> Monitor | <input type="checkbox"/> Archive |

References:

Aziz S, Ramsdale DR. Chronic total occlusions – A stiff challenge requiring a major breakthrough: is there light at the end of the tunnel? *Heart* 2005; **91**: 42-48.

Baim DS, Braden G, Heuser R, Pompa JJ, Cutlip DE, Massaro JM, Marulkar S, Arvay LJ, Kuntz RE. Utility of the Safe-Cross-Guided Radiofrequency Total Occlusion Crossing System in chronic coronary total occlusions (Results from the



**Guided Radio Frequency Energy Ablation of Total Occlusions Registry Study).
American Journal of Cardiology 2004; 94(1): 853-858.**

Burchenal J, Maddux J, Dehmer GJ, Talavera F, Runge MS, Suleman A, Zevitz ME.
Percutaneous transluminal coronary angioplasty. Last updated 2003.
<http://www.emedicine.com/med/topic3199.htm> [Accessed August 2005]

Chen WH, Ng W, Lee PY, Lau CP. Recanalization of chronic and long-occlusive in-stent restenosis using optical coherence reflectometry-guided radiofrequency ablation guidewire. *Catheterization and Cardiovascular Interventions* 2003; 59(2): 223-229.

CMS – Tracking form for applicants for new technology add-on payments under the acute inpatient prospective payment system. Last updated 2004.
<http://www.cms.hhs.gov/providers/hipps/IntraLuminalfinalTrackingForm112404.pdf>
[Accessed August 2005].

Hoye A, Lemos PA, Serruys PW. Successful use of a new guidewire with radiofrequency ablation capability for the treatment of chronic total occlusion at the ostium of the left anterior descending artery. *Journal of Invasive Cardiology* 2005; 17(5): 227-229.

Lee PY, Chen WH, Ng W, Lau CP. Percutaneous recanalization of chronic subclavian artery occlusion using optical coherence reflectometry-guided radiofrequency ablation guidewire. *Catheterization and Cardiovascular Interventions* 2003; 60(4): 558-561.

Medicare Australia. Medicare Benefits Schedule May 2005. Last updated 2005.
<http://www9.health.gov.au/mbs/> [Accessed August 2005].

Ng W, Chen WH, Lee PY, Lau CP. Initial experience and safety in the treatment of chronic total coronary occlusions with a new optical coherent reflectometry-guided radiofrequency ablation guidewire. *American Journal of Cardiology* 2003; 92(6): 732-734.

Shammas NW. Treatment of chronic total occlusions using optical coherent reflectometry and radiofrequency ablative energy: Incremental success over conventional techniques. *Journal of Invasive Cardiology* 2004; 16(2): 58-59.

Singh VN. Coronary artery atherosclerosis. Last updated January 2005.
<http://www.emedicine.com/med/topic446.htm> [Accessed August 2005].

Sionis DG, Tolis VA, Michalis LK. Chronic total coronary occlusions: A review of their special features and the existing techniques of percutaneous treatment. *Hellenic Journal of Cardiology* 2003; 44: 136-142.

Wong P, Tse KK, Chan W. Recanalization of chronic total occlusion after conventional guidewire failure: Guided by optical coherent reflectometry and



facilitated by radiofrequency energy ablation. *Journal of Invasive Cardiology* 2004; 16(2): 54-57.

Sources of Further Information:

Intraluminal Therapeutics Inc. Last updated 2005.

<http://www.intraluminal.com/> [Accessed August 2005]

Kirvatiis RJ, Heuser RR, Das TS, Laster SB, Dippel EJ, Gammon RS, Bottu CF, Murphy BE, Biggs TA, Shimshak TA, Laird JR, Foster MT, Wholey M. Usefulness of optical coherent reflectometry with guided radiofrequency energy to treat chronic total occlusions in peripheral arteries (the GRIP trial). *American Journal of Cardiology* 2004 **95**(15): 1081-1084.

Search Criteria:

A search of MEDLINE, PubMed and Cochrane Library, Current Controlled Trials metaRegister, UK National Research Register, International Network for Agencies for Health Technology Assessments, relevant online journals and the Internet was conducted in August 2005.

Search terms used were: 'Safe-Cross', 'Radiofrequency total occlusion ablation', and 'Radiofrequency guidewire'.

This Horizon Scanning Prioritising Summary was prepared by Mr. Irving Lee from the NET-S Project, ASERNIP-S for the Health Policy Advisory Committee on Technology (Health PACT), on behalf of the Medical Services Advisory Committee (MSAC) and the Australian Health Ministers' Advisory Council (AHMAC).