Recurrent In-Stent Restenosis With Total Occlusion Remedied With Drug-Eluting Balloon Angioplasty

A Case Report

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Summary

We report a 69 year old female who presented with chest pain to the Emergency Department of the National Heart Institute Malaysia. Her history revealed that she had had 2 separate episodes of chest pain beginning in 2002, resulting in total occlusion of her mid left anterior descending artery (LAD) requiring percutaneous coronary intervention and stenting on both occasions. Cine angiogram on her current admission revealed recurrent target lesion in-stent restenosis with total occlusion of the distal LAD. Intravascular ultrasound revealed multilayered suboptimally deployed stents in the LAD. Successive drug-eluting balloon deployments resulted in sustained patency of the LAD after 1 year. (Int Heart J 2011; 52: 61-63)

Key words: In-stent restenosis, Angioplasty, Drug-eluting balloon

Stents are a crucial and indispensable tool for coronary interventionists. Their efficacy, however, has been limited by the development of in-stent restenosis (ISR) secondary to neointimal proliferation.1 Drug-eluting stents (DES) have, in the past decade, markedly reduced the incidence of binary restenosis and repeat coronary revascularization.2 However, there is limited data on optimal management of DES restenosis. Some studies have shown similar benefits between repeat DES stenting and conventional balloon angioplasty, whereas others have shown clear benefit for repeat DES stenting.3,4 Percutaneous coronary balloon angioplasty has been largely superseded by repeat DES stenting or the ‘sandwich stenting’ technique, which is steadily gaining prominence.5 We report a case of recalcitrant target lesion ISR which was successfully treated with drug-eluting balloon deployment. A repeat coronary angiogram 1 year later revealed sustained target lesion patency and the patient remains symptom free.

Case Report

A 69-year-old female with a history of diabetes, hypertension, and hyperlipidemia since 1990 and on regular medication, has had recurrent episodes of stable angina since 1997. She was put on aspirin but was never investigated for coronary artery disease due to patient refusal to consent for further evaluation or intervention.

In 2002, she had a severe episode of chest pain which necessitated admission to a peripheral hospital from where she was eventually referred to the National Heart Institute in Kuala Lumpur. Her coronary angiogram then revealed a total occlusion of the left anterior descending artery (LAD) which was remedied with two overlapping Cypher DES extending from the mid to distal LAD (2.5 × 33 mm and 2.75 × 33 mm, CypherTM sirolimus-eluting stent; Cordis Corp., Miami, FL) (Figures 1A-F). She was discharged with dual antiplatelet therapy.

In 2003, she had recurrent symptoms and a repeat angiogram showed ISR with total occlusion of the mid LAD. Percutaneous coronary intervention (PCI) was attempted with a cutting balloon (3.0 × 15 mm, 3.5 × 15 mm and 4.0 × 10 mm; InterVentional Technologies Inc., San Diego, CA). This was followed by two bare-metal stents (BMS), Multi-Link Penta® (Guidant Corp., Indianapolis, IN) 4.0 × 13 mm in the proximal LAD, overlapped distally with the proximal Cypher. A Driver® (Medtronic, Santa Rosa, CA) 3.0 × 18 mm was also deployed into D1.

The PCI was complicated by perforation in the mid LAD distal to D1, which was bailed out using the ‘sandwich stenting’ technique with 2 Jomed covered stents (Abbott Vascular Devices, Redwood City, CA) 4.0 × 12 mm across D1 and 3.5 × 12 mm overlapped distally. The final angiographic result was acceptable with TIMI III flow to distal LAD and patent septals/D2 despite an obliterated D1. The patient was discharged well and remained asymptomatic for many years.

In 2008, she again developed recurrent symptoms of severe chest pain necessitating hospital admission. Electrocardiography (ECG) showed sinus rhythm with no ST-T changes and an echocardiogram (ECHO) revealed a good left-ventricular ejection fraction of 64%, concentric left ventricular hypertrophy with mild diastolic dysfunction, but no regional wall motion abnormality.

Coronary angiography revealed recurrent mid LAD ISR with total occlusion distal to D1 (Figures 2A-B). The presence of overlapping Cypher DES and sandwiched Cypher/Jomed...
covered stents from the proximal to mid LAD precluded the use of further DES stenting and necessitated the use of drug-eluting POBA. A conventional antegrade approach via a 6 Fr Launcher\textsuperscript{TM} Extra Back-Up (EBU) 3.5 guide (Medtronic, USA) for the LAD was performed with a Runthrough\textsuperscript{TM} Intermediate wire (Terumo Inc, Japan). Sequential low-pressure dilatation was performed with a SeQuent\textsuperscript{R⃝} 2.0 × 15 mm balloon (B. Braun Medical Inc., Bethlehem, PA). Intravascular ultrasound (IVUS) revealed multilayered suboptimally deployed stents in the LAD but neither stent fractures nor overlap-free segments were present. Furthermore, there was moderate neointimal hyperplasia but no thrombus-like images were seen (Figures 3A-B).

POBA was performed with sequential, distal to proximal, dilatation of the SeQuent\textsuperscript{R⃝} Please (B. Braun Medical Inc.) paclitaxel-eluting balloon 2.5 × 30 mm deployed at 8 atm/45 seconds, 3.0 × 26 mm at 16 atm/45 seconds and 3.5 × 26 mm at 16 atm/45 seconds (Figures 2C-E). Postdilatation IVUS revealed proper stent expansion and apposition (Figures 3C-D). Final cine confirmed TIMI III flow to the distal LAD, patent septals and D\textsubscript{2} (Figures 2F-G).

She was then discharged well with medications. She remained asymptomatic under regular follow-up for the succeeding year. Repeat angiogram on 15\textsuperscript{th} January 2009 revealed a
patent LAD with moderate ISR and TIMI III flow (Figure 4).

**Discussion**

Our patient had several factors associated with higher risk of restenosis, namely, age, female sex, and diabetes. Nonetheless, these factors are thought to have diminished with the advent of DES wherein vessel characteristics and type of DES used became stronger predictors of both angiographic and clinical restenosis. However, despite dual antiplatelet therapy, utilisation of sirolimus-coated stents, in a large calibre coronary artery and achieving good post-PCI angiographic results following the first PCI, our patient still had recurrent target lesion ISR in 2003.

She did not display any of the usual causes of DES ISR such as stent fracture, edge proliferation, overlap-free areas, or bifurcation stenting. Furthermore, neither cutting balloon utilisation nor sandwich stenting managed to prevent further recurrent target lesion ISR following the second PCI. Both methods have been described as therapeutic breakthroughs in treating ISR. Following the second PCI in 2003, however, the risks for ISR increased substantially due to the anatomic location (LAD), vessel geometry, the number and length of stents, and the presence of multiple overlaps.

Many studies have shown good results for the sandwich stenting technique in which a DES is implanted into a BMS ISR. However, the data for such a procedure or any other intravascular intervention for that matter, in a DES ISR are still limited, although some reports are encouraging. Paclitaxel-coated balloon catheters (DEB) offer more therapeutic advantages through immediate drug delivery on inflation, administration of a controlled dose, and homogeneity of vessel wall exposure without the disadvantages of a polymeric matrix that may induce inflammation and thrombosis.

In addition, intracoronary delivery of paclitaxel by a DEB catheter results in concentrations of the drug in vascular tissue that are high enough to have antiproliferative effects, thus leading to a significant reduction in neointimal proliferation. Results from the Paccocath ISR VII and the PEPCAD II studies have shown that the DEB is associated with greater procedural success, lower binary restenosis rates, and lower major adverse cardiovascular event rates. These factors point towards a promising future for the DEB in treating ISR.

We have shown that despite multiple complicated PCI attempts on a recalcitrant target lesion, satisfactory results were achieved through preemptive deliberation and utilization of the DEB, a novel breakthrough for the treatment of ISR.

**References**