Acta Cardiol Sin 2017;33:92–95
Case Report
doi: 10.6515/ACS20160328A

IVUS-Guided Implantation of Bioresorbable Vascular Scaffolds for Very Late Paclitaxel Stent Thrombosis

Zhe-Zhong Lin,[1,2] Wei-Ting Chang,[3] Chun-Yen Chiang,[3] Zhih-Cherng Chen[3] and Po-Ming Ku[4,5]

Bioresorbable vascular scaffold (BVS) implantation has been shown to be safe in patients with stable coronary disease, and effective against the thrombotic lesion and the in-stent restenosis (ISR) of the drug-eluting stent (DES). BVSs have the advantages of a snow racket concept, positive vessel remodeling, and better conformability compared with DES in acute coronary syndrome (ACS). We report on a young patient with ST-elevation myocardial infarction (STEMI) who presented to our emergency department arising from very late stent thrombosis (VLST) of a 2.5 × 28 mm paclitaxel-eluting stent (Coroflex® Please) three years after its implantation. After the patient was treated with balloon dilation, intravascular ultrasound (IVUS) revealed a short segment of a guide wire outside the DES mesh. Two BVSs were implanted to prevent a DES recoil. Post-scaffold-implantation IVUS showed adequately expanded strut of BVSs. Six months later, optical coherence tomography (OCT) revealed that some segments of the scaffold had been absorbed and that there was no in-scaffold restenosis. The patient had not complained about angina during the out-patient clinic follow-up. This is the first report of successful BVS implantation for a STEMI patient attributable to DES VLST.

Key Words: Bioresorbable vascular scaffold (BVS) • In-stent restenosis (ISR) • Very late stent thrombus (VLST)

INTRODUCTION

Percutaneous coronary intervention (PCI) with a metallic drug-eluting stent (DES) to treat coronary artery disease (CAD) is a well-established treatment. However, in-stent restenosis (ISR) is an adverse event after DES implantation.

The ABSORB EXTEND study showed that PCI with an everolimus-eluting bioresorbable vascular scaffold (BVS, Abbott Vascular, Santa Clara, CA, USA) implantation was safe in patients with chronic de novo CAD.[1] In 2013, Grasso et al. reported a case with a patent coronary artery 9 months after a BVS implantation to treat DES ISR.[2] In 2014, Diletti et al.[3] reported 49 patients with ST-elevation myocardial infarction (STEMI) who underwent primary PCI with BVS implantation for treatment of de novo native CAD. Only one major adverse cardiac event (MACE) occurred during the 30-day follow-up.

Our literature review showed there were neither case reports nor original studies on BVS implantation in very late stent thrombosis (VLST). We herein report a 46-year-old man with STEMI due to very late paclitaxel-eluting stent thrombosis successfully treated with PCI of BVS implantation.

CASE REPORT

A 46-year-old man presented to our emergency de-

Received: October 14, 2015 Accepted: March 28, 2016
[1]Department of Cardiology, Chi Mei Medical Center, Liouying; [2]Department of Leisure and Sports Management, Far East University; [3]Department of Cardiology, Chi Mei Medical Center, Yongkang; [4]Cardiovascular Center, Chi Mei Medical Center, Liouying; [5]Chia Nan University of Pharmacy & Science, Tainan, Taiwan.
Corresponding author: Dr. Po-Ming Ku, Cardiovascular Center, Chi Mei Medical Center, No. 201, Taikang, Liuying Dist., Tainan City 736, Taiwan. Tel: 886-6-622-6999 ext. 77221; E-mail: kupoming@gmail.com

partment (ED) with anterior chest pain while working. He had a history of hypertension and CAD, a single-vessel disease treated in 2012 with a 2.5 × 28 mm paclitaxel-eluting stent (Coroflex® Please; B. Braun Melsungen AG, Berlin, Germany) for the middle right coronary artery (mRCA). An electrocardiograph showed ST elevation in leads II, III, and aVF (Figure 1A).

A coronary angiogram accessed through the left radial artery showed a patent left coronary artery, but no flow because of in-stent thrombosis in the middle RCA (Figure 1B). RCA was engaged by 6Fr Amplatz left 1 (AL1, Boston Scientific, USA) guiding catheter. 100 mg of intracoronary nitroglycerin was injected before angioplasty. SION blue (Asahi Intecc Co., Aichi, Japan) guide wire was advanced to distal RCA. Aspiration thrombectomy catheter (Pronto V3® extraction catheter; Vascular Solutions, Inc., Minneapolis, MN, USA) and intravascular ultrasound (IVUS) failed to pass ISR of middle RCA. ISR of middle RCA was inflated with Maverick® 1.5 × 20 mm 16 atm (Boston Scientific, Marlborough, MA, USA). Subsequent use of an aspiration thrombectomy catheter (Pronto V3®) aspirated substantial thrombus. Thereafter, 100 mg of intracoronary nitroglycerin was administrated before IVUS was performed. IVUS demonstrated neointimal hyperplasia and a short segment of guidewire outside the mesh of the previous DES (Coroflex® Please) (Figure 1D & 1E). Distal RCA was dilated with NC Quantum Apex 3.0 × 20 mm 12 atm (Boston Scientific Corporation, Miami, USA) and middle RCA was dilated up to 16 atm. IVUS revealed a short segment of previous DES (Coroflex® Please) was crushed after predilation, with other segments well pre-dilated. A BVS Absorb 2.5 × 18 mm was delivered across the crushed segment of the previous metallic stent smoothly and was implanted up to 12 atm over distal-RCA; another BVS Absorb 3.0 × 28 mm was implanted up to 12 atm over the middle-RCA. IVUS showed BVS Absorb was well-expanded (Figure 1F). Post-scaffold angiogram showed adequate RCA flow (Figure 1G). Dual anti-platelet therapy with aspirin 100 mg once daily and clopidogrel 75 mg once daily was prescribed. Peak value of cardiac necrotic makers were creatine kinase-MB 352.9 ng/ml, creatine kinase-total 3359 U/L, troponin I 142.25 ng/ml. He was transferred to the ordinary ward the following day. Echocardiography disclosed a left ventricular ejection fraction of 58.1%, with basal posterior and anterolateral wall hypokinesia. Heparinization intravenously was given for 48 hours. Ultimately, the patient was discharged on the fourth day after admission.

Six months after BVS implantation, optical coherence tomography (OCT) showed that some segments of the scaffold were absorbed and that no in-scaffold restenosis occurred (Figure 2B). The patient had not complained about angina during the out-patient clinic follow-up.

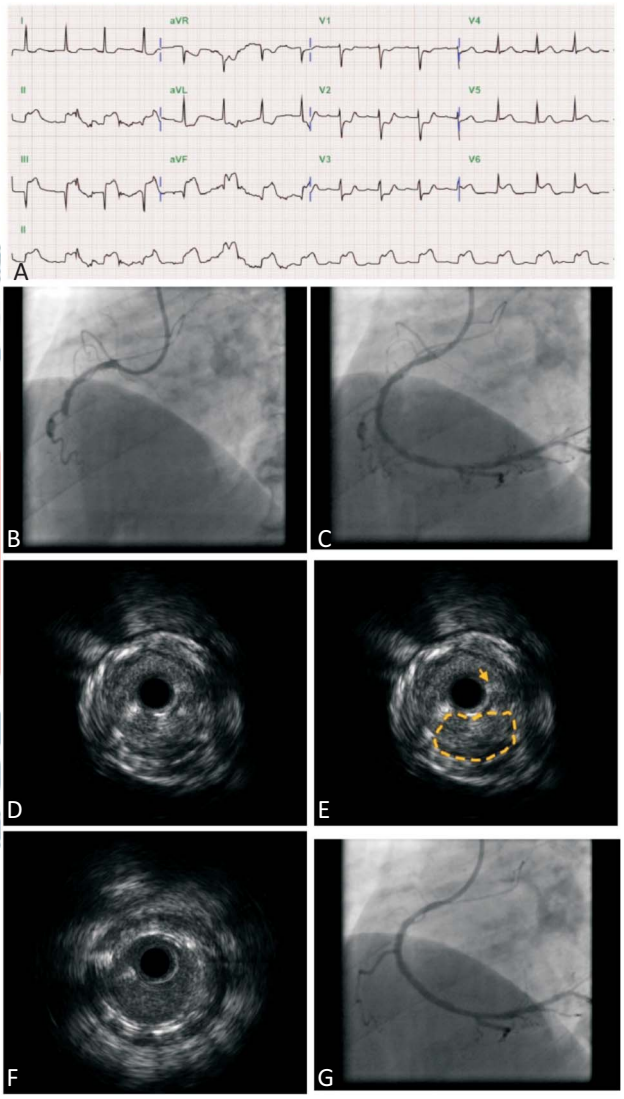

Figure 1. *(A) ST elevation in leads II, III, and aVF on an electrocardiograph. (B) Coronary angiogram showed no flow because of in-stent thrombus in the middle right coronary artery. (C) Flow was TIMI 2 to 3 after percutaneous transmural balloon angioplasty. (D) Intravascular ultrasound (IVUS) revealed wire outside the mesh of previous stent. (E) IVUS showed wire (yellow arrow) outside the mesh (yellow line drawn circumference) of previous stent. (F) IVUS disclosed BVS well expanded over the crushed segment of DES. (G) Flow recovered after BVS implantation.*

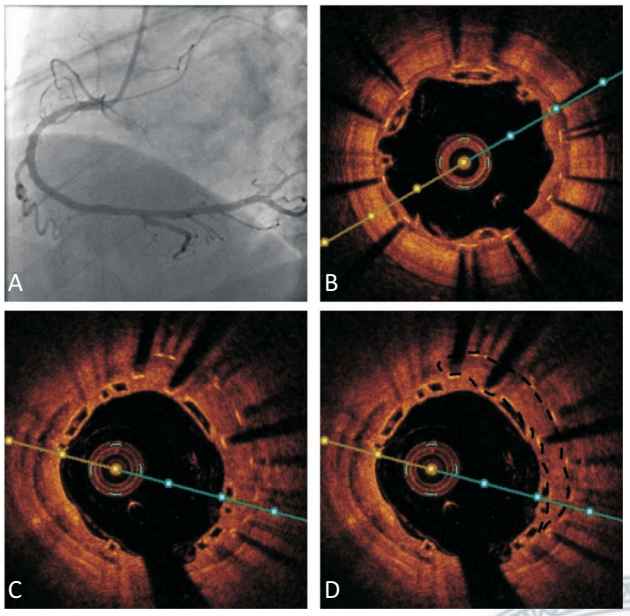

Figure 2. *(A) Coronary angiograph showed a patent right coronary artery. (B) Optical coherence tomography (OCT) revealed some segments of scaffold absorbed. (C) OCT disclosed two layers of the mesh of previous stent. (D) OCT disclosed two layers of the mesh of previous stent (black line drawn circumference) outside BVS.*

DISCUSSION

BVS had a potential advantage in acute coronary syndrome (ACS) over DES. These might contribute to a snow racket concept,[3,4] positive remodeling, and better conformability. The POLAR ACS study in 2014, which included 100 patients with ACS, showed only 1 additional stent thrombosis as well as 1 target lesion revascularization (TLR) after BVS procedure during the one-year follow-up.[5] Gori et al. in 2014 analyzed in-hospital, 30-day and 6-month MACE rates, which were found to be similar between BVS and everolimus drug-eluting stent (DES) implantation groups (all $p > 0.5$) among patients with ACS.[6] These two studies revealed BVS implantation was safe to conduct in patients with ACS.

The Prague 19 study in 2014 revealed that in patients with STEMI, the BVS device success rate was 98%, post-thrombolysis restored flow 3 was 95%, and acute scaffold recoil was 9.7%.[7] The early clinical results of BVS implantation were encouraging.[8] The BVS STEMI first study in 2014 showed a procedural success rate of 97.9% among 49 patients with STEMI implanted with BVS.[3] At the 30-day follow-up, target-lesion failure rate was 0%.[3] No target-vessel revascularization and target vessel myocardial infarction (MI) were reported, and no cases of cardiac death or scaffold thrombosis were observed.[3]

Drug-eluting stent (DES) had the adverse event of VLST. Generally, the risk factors for VLST were diabetes, heart failure, chronic kidney disease or end-stage renal disease,[8] long lesion, small vessel size, calcific plaque, and long stent. Recently, IVUS or OCT-guided studies reported mechanisms of VLST were underexpanded or malapposed stent struts, neoatherosclerosis, drug-resistance or local hypersensitivity reaction, and stent fractures. Everolimus-eluting stent had a lesser rate of VLSR compared with Paclitaxel-eluting stent.[4] The treatments for ISR of metallic paclitaxel-eluting stent included drug-eluting balloon (drug-coating balloon), another kind of drug-eluting stent, and BVS.[9] In our case, because the guide wire was outside the mesh of the previous stent, stent crushed by balloon dilatation to enlarge the lumen was necessary. After balloon, stent or scaffold was also necessary to prevent recoil. If DES were deployed, there were three layers of stent strut in the middle RCA. However, BVS was preferred over DES in young patients owing to reduced metallic stent strut in the future. Due to paclitaxel-eluting stent thrombosis, everolimus-eluting BVS implantation was favored over DEB.

CONCLUSIONS

We have reported the first case with very late paclitaxel-eluting stent thrombosis successfully treated with IVUS-guided implantation of BVS in a patient with STEMI. Due to a guide wire outside the metallic stent mesh, and very late paclitaxel-eluting stent thrombosis, everolimus-eluting BVS implantation was favored. OCT showed satisfactory results, demonstrating that implantation of BVS in a STEMI patient due to VLST of DES was feasible.

REFERENCES

1. Abizaid A, Costa JR Jr, Bartorelli AL, et al. The ABSORB EXTEND study: preliminary report of the twelve-month clinical outcomes in the first 512 patients enrolled. *EuroIntervention* 2015;10: 1396-401.
2. Grasso C, Attizzani GF, Patané M. First-in-human description of

everolimus-eluting bioabsorbable vascular scaffold implantation for the treatment of drug-eluting stent failure: insights from optical coherence tomography. *Int J Cardiol* 2013;168:4490-1.
3. Diletti R, Karanasos A, Muramatsu T, et al. Everolimus-eluting bioresorbable vascular scaffolds for treatment of patients presenting with ST-segment elevation myocardial infarction: BVS STEMI first study. *Eur Heart J* 2014;35:777-86.
4. Barbato E, Wijns W. Bioresorbable coronary scaffolds: a novel device-based solution in search of its clinical need. *Eur Heart J* 2014;35:753-7.
5. Dudek D, Rzeszutko Ł, Zasada W, et al. Bioresorbable vascular scaffolds in patients with acute coronary syndromes: the POLAR ACS study. *Pol Arch Med Wewn* 2014;124:669-77.
6. Gori T, Schulz E, Hink U, et al. Early outcome after implantation of absorb bioresorbable drug-eluting scaffolds in patients with acute coronary syndromes. *EuroIntervention* 2014;9:1036-41.
7. Kočka V, Malý M, Toušek P, et al. Bioresorbable vascular scaffolds in acute ST-segment elevation myocardial infarction: a prospective multicentre study 'Prague 19'. *Eur Heart J* 2014;35:787-94.
8. Ku PM, Huang TY, Chen ZC, et al. IVUS-guided rotational atherectomy for unexpandable paclitaxel-eluting stent: a case report and review of literature. *J Geriatr Cardiol* 2013;10:226-9.
9. Alfonso F, Byrne RA, Rivero F, Kastrati A. Current treatment of in-stent restenosis. *J Am Coll Cardiol* 2014;63:2659-73.