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Double Total Occlusion of Bioresorbable Scaffold in a Young Patient with Coronary Artery Ectasia

Mei-Tzu Wang,[1,2] Wei-Chun Huang,[1,2,3,4,5,6] Feng-You Kuo[1,2,4] and Guang-Yuan Mar[1,2,3]

INTRODUCTION

Coronary artery ectasia (CAE) is found in up to 1.2%-4.9% of patients undergoing coronary angiography, with predilection for men.[1,2] Most affected artery is right coronary artery (RCA) (40%), followed by the left anterior descending (LAD) (32%) and the left main artery (LCx) (3.5%).[3] Coronary artery aneurysm (CAA) was defined as dilated diameter of coronary artery of at least 1.5 times compared with normal adjacent segments or the largest coronary artery.[4] CAE and CAA have previously been used interchangeably, however, the term CAE is used to define more diffuse aneurysmal lesions.[4,5] CAA coexisted with coronary artery disease (CAD) more frequently than CAE, and the average maximum diameter was smaller in CAA. Multivariate analysis showed independent variables associated with CAA rather than CAE, including hyperlipidemia, smoking, and family history of CAD.[5] Within aneurysmal segments, abnormal laminar flow and platelet-endothelial-derived pathophysiologic factors lead to thrombus formation.[6] Clinical symptoms range from asymptomatic, effort angina to acute coronary syndrome.[4]

The majority of published studies assessed percutaneous coronary intervention (PCI) outcomes in patients with CAE was under clinical setting of acute myocardial infarction, whereas discussions of asymptomatic patients or elective intervention were only limited small case series.[7] The treatment modality of elective intervention (covered stent exclusion, stent-assisted coil embolization, or surgical exclusion) differs according to the shape and extent of the lesion.[4] Intracoronary manipulation of CAE has complications of distal embolization, no-reflow phenomenon, stent malapposition, dissection and rupture. Furthermore, iatrogenic CAE was also induced after stenting.[4]

CASE

A 36-year-old man had stable angina for one month. Myocardial perfusion scan revealed reversible defect in apex, anterior wall, septal and anterolateral walls (Figure 1A). Coronary angiography (CAG) disclosed diffuse CAE with severe stenosis over three vessels (Figure 1B, D). Under optical coherence tomography (OCT), RCA segment 2 was notable of plaque erosion within CAE (Figure 1F, G). Staged PCI was performed with three bioresorbable scaffolds (BRS) (Abbott Vascular) implanted over segment 1, 6 and 7 (Figure 1C, E). OCT was checked before and after intervention (Figure 1H, I).

Five months later, followed computed tomography angiography (CTA) revealed patent segment 1, 6 and 7 (Figure 2A, B). However, twenty months later, there was total occlusion over segment 7 of left anterior descending coronary artery (LAD) (Figure 2C, D), and coronary CTA also reported total occlusion over segment 1 (Figure 2F). Three-dimensional reconstruction of coronary angiography disclosed double total occlusion over LAD and RCA (Figure 2E). CAG revealed collateral supply between LAD septal branches and RCA (Figure 2G, H). Previous treated segment 7 presented with struts malappostion, struts floating and new-developed CAE lesions (Figure 2I, J) under OCT. Segment 6 was patent, and intervention was not done (Figure 2K). However, segment 7 was

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[1]Department of Critical Care Medicine; [2]Department of Cardiology, Cardiovascular Center, Department of Internal Medicine, Kaohsiung Veterans General Hospital, Kaohsiung; [3]National Defense Medical Center, National Defense University; [4]School of Medicine, National Yang-Ming University, Taipei; [5]Department of Physical Therapy, Fooyin University; [6]Graduate Institute of Clinical Medicine, Kaohsiung Medical University, Kaohsiung, Taiwan.
Corresponding author: Dr. Wei-Chun Huang, Department of Critical Care Medicine, Kaohsiung Veterans General Hospital, No. 386, Dazhong 1st Rd., Zuoying Dist., Kaohsiung City 813, Taiwan. Tel: 886-7-346-8278; Fax: 886-7-345-5045; E-mail: wchuanglulu@gmail.com

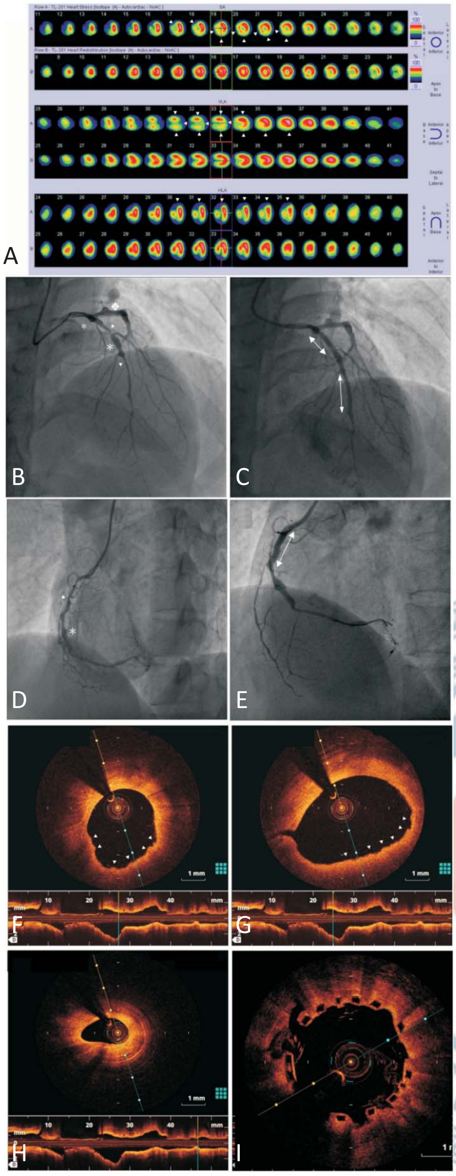

Figure 1. *Baseline myocardial perfusion scan and images during bioresorbable scaffold implantation. (A) Myocardial perfusion scan revealed reversible defect in apex, anterior wall, septal and anterolateral walls (arrowhead). (B) CAG was severe stenosis over segment 6 and segment 7 (arrowhead), with adjacent coronary artery ectasia (CAE) lesions (aster). LCX was notable of one coronary artery aneurysm (diamond). (C) Final result of LAD after two BRS deployment over segment 6 (3.5 mm × 12 mm) and segment 7 (2.5 mm × 28 mm) was optimal, and CAE between two lesions was skipped, without intervention. (D) RCA revealed 90% stenosis over segment 1 (arrowhead) and one CAE over segment 2 (aster). (E) One BRS was implanted over segment 1 (3.5 mm × 28 mm). (F, G) CAE of segment 2 was noted under OCT, with plaque erosion (arrowhead). (H) OCT image was checked before segment 1 intervention. (I) After BRS deployment over segment 1, OCT revealed well attached struts to the vessel wall. BRS, bioresorbable scaffolds; CAG, coronary angiography; LAD, left anterior descending coronary artery; LCX, left circumflex; OCT, optical coherence tomography; RCA, right coronary artery.*

total occlusive and recanalized with one drug-eluting stent (DES) (3 × 15 mm). OCT was checked after intervention, and stent attached well to the vessel wall (Figure 2L). RCA was successfully recanalized via retrograde approach (Figure 2M), and three DES (2.25 mm × 28 mm, 3.0 mm × 28 mm, 3.5 mm × 28 mm) were deployed over RCA from distal to proximal segment (Figure 2N). Thirty-two months later, followed CAG disclosed LAD segment 7 total occlusion, and one DES (2.5 mm × 48 mm) was deployed over the lesion. Dual antiplatelet agents with aspirin and clopidogrel has been prescribed following each coronary artery stenting since the first-time intervention.

DISCUSSION

The ideal interventional method to treat CAE is inconclusive. Each modality has its pros and cons. For bare metal stent, it has risk of hypersensitivity to stainless-steel stent and increased frequency of in-stent restenosis.[8] For drug-eluting stent, its impaired intimal healing effects of the antiproliferative agents after stent deployment was associated with CAE formation, despite fewer published reports after second- and third-generation stents deployment.[9] Covered stent might be suitable for saccular aneurysms and small pseudoaneurysms if there was no involvement of major side branches.[4] Stent-assisted coiling or surgical exclusion could be considered for coronary arteries with severe tortuosity, calcification, or fear of side branch compromise in saccular or fusiform aneurysms with major side branch involvement.[10] Regarding medical management, aspirin was suggested due to the coexistence of CAE with obstructive coronary lesions and the incidence of myocardial infarction.[11] Moreover, chronic anticoagulation with warfarin could be considered, based on the concern for flow disturbances within the ecstatic segments.[12,13]

In this case, OCT revealed well attached struts to the vessel wall in segment 7 initially, following with struts malappostion, struts floating and new-developed CAE lesions after twenty months. Late stent malappostion complicated with aneurysm formation and stent thrombosis were described in DES rather than in BRS.[13] Acute malappostion involves differences in neointimal thickness on abluminal and adluminal sides.[13] The advan-

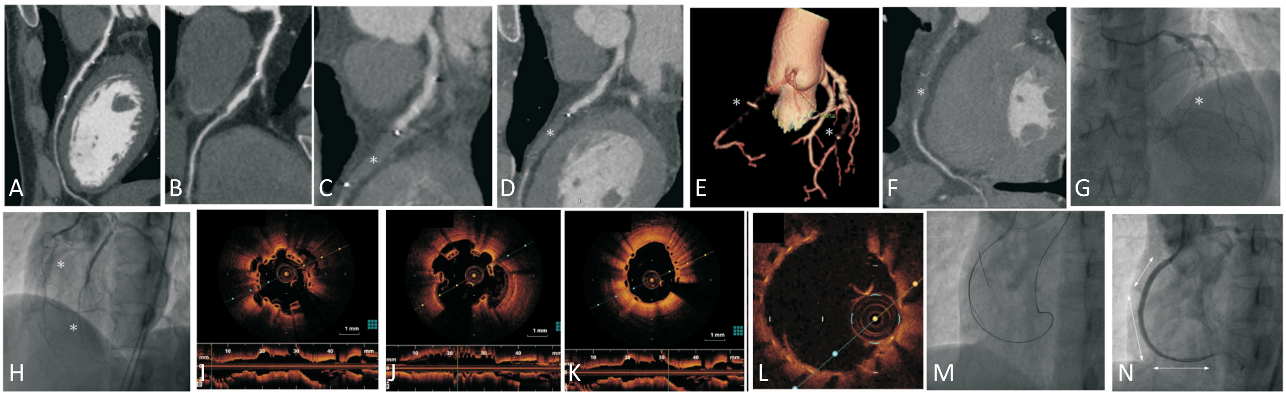

Figure 2. *Series followed coronary images five months and twenty months after bioresorbable scaffold deployment (A to H) and followed intracoronary images twenty months after bioresorbable scaffold deployment (I to N). (A) Five months later, followed CTA revealed patent LAD over segment 6 and 7. (B) RCA was also patent after previous BRS deployment. (C, D) Twenty months later, there was total occlusive segment 7 of LAD (aster) under CTA. (E) Three-dimensional coronary reorganized angiography disclosed double total occlusive RCA and middle LAD (aster). (F) CTA revealed total occlusive RCA (aster). (G, H) CAG presented double total occlusion over LAD and RCA (aster), with collateral supply between LAD septal branches and RCA. (I, J) Previous treated segment 7 presented with struts malappostion, struts floating and new-developed CAE lesions under OCT. (K) Segment 6 was patent, and intervention was not done. (L) After recanalization of LAD with one DES deployed over segment 7, OCT was done, and stent attached well to the vessel wall. (M) RCA was successfully recanalized via retrograde approach. (N) Three DES (2.25 mm × 28 mm, 3.0 mm × 28 mm, 3.5 mm × 28 mm) were deployed over RCA from distal to proximal segment. BRS, bioresorbable scaffolds; CAA, coronary artery aneurysm; CAG, coronary angiography; CTA, computed tomography angiography; DES, drug-eluting stent; LAD, left anterior descending coronary artery; OCT, optical coherence tomography; PCI, percutaneous coronary intervention; RCA, right coronary artery.*

tages of BRS include completed scaffold resorption, anatomic restoration, and thrombogenic risk attenuation.[14] However, in this case, in-stent restenosis and recurrent total occlusion were shown after BRS deployment in patient with CAE. The putative mechanism might come from genetic susceptibility of the patient, thicker struts of BRS, slower expandability and higher pressures of balloon inflations, causing deep arterial wall injury/inflammation and CAE formation after intervention.[15]

LEARNING POINTS

1. The putative mechanism of CAE formation might come from genetic susceptibility of the patient, thicker struts of BRS, deep arterial wall injury/inflammation and CAE formation associated with slower expandability and higher pressures of balloon inflations.
2. The ideal interventional method for CAE is inconclusive until now. Newer-generation devices with both completed scaffold resorption, thinner struts and less inflammation reaction are anticipated. We present the case to evoke advanced discussion of the feasibility and safety of BRS application in coronary artery aneurysm.

CONSENT FOR PUBLICATION

All authors give their consent for publication.

CONFLICTS OF INTEREST

All authors report no conflict of interest.

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