Case Reports

Revascularization of Malignant Coronary Instent Restenosis Resulting From Takayasu's Arteritis Using Sirolimus-Eluting Stents

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SUMMARY

A 37 year-old female who had suffered from arteritis for 20 years underwent a Bentall operation. Since severe stenosis was observed in her left main coronary artery (LMCA) the following year, a minimally invasive direct coronary artery bypass (MIDCAB) operation was performed. Unfortunately, she again complained of angina about 6 months after the second surgery and coronary angiography (CAG) revealed that her left internal thoracic artery graft was totally occluded. Although a 4.0 × 15 mm S670 stent was placed in her LMCA, the LMCA restenosed every 3 months and she underwent reintervention 8 times. We placed 2 sirolimus-eluting stents for treating the LMCA using the culottes stenting technique. CAG 6 months after the index procedure showed no stenosis at her LMCA. Sirolimus-eluting stents were effective for treating stenosis resulting from arteritis as well as that caused by atherosclerosis. (Int Heart J 2006; 47: 795-801)

Key words: Arteritis, Restenosis, Sirolimus, Stent

SIROLIMUS has an antiproliferative effect against vascular smooth muscle cells, and many investigators have already reported that sirolimus-eluting stent (SES) placement is more effective for treating atherosclerotic coronary artery narrowing than conventional bare metal stent placement. However, there have been very few reports on whether SES placement is effective against coronary artery stenosis caused by arteritis.

We report herein the case of a young female patient suffering from arteritis in whom malignant instent restenosis was treated successfully with an SES. This is a rare case showing the efficacy of SES for treating LMCA stenosis caused by arteritis.

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CASE REPORT

A 37 year-old female was referred to our institution by another hospital in order to treat her transluminally. She had suffered from Takayasu's arteritis for 20 years, and received an aortic valve replacement (AVR) using a bioprosthetic valve when she was 27 years old. In the following year, complete atrioventricular block appeared, and she underwent permanent pacemaker implantation. Since an aortic root aneurysm appeared when she was 34 years old, a Bentall operation and reAVR were performed. That is, her aortic valve was exchanged to a mechanical prosthetic valve and her LMCA was reconstructed using the Piehler technique.[1] Another year later, she complained of chest pain and coronary angiography (CAG) revealed that her native LMCA was severely stenosed. Her left internal thoracic artery (LITA) was grafted onto her left anterior descending coronary artery (LAD) with a minimally invasive direct coronary artery bypass (MID-CAB) operation. She again complained of angina about 6 months after the MID-CAB operation and CAG revealed that her LITA graft was totally occluded (Figure 1). A 4.0 × 15 mm S670 stent (Medtronic AVE) was placed onto the

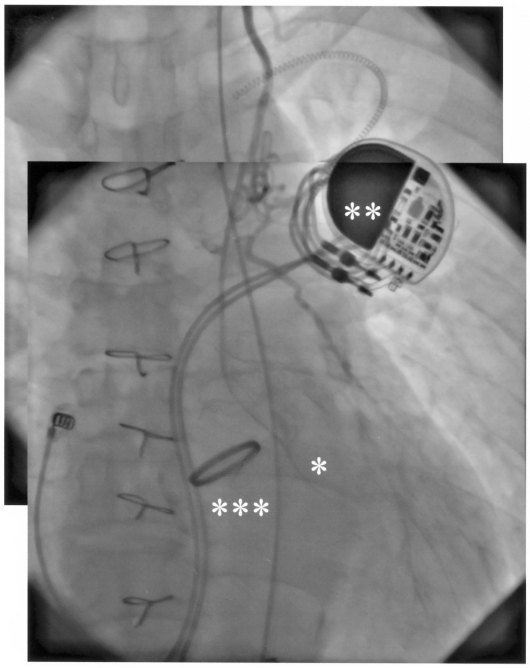

Figure 1. Angiography of left internal thoracic artery.
* : Anastomosis of left internal thoracic artery graft was occluded.
** : Implanted permanent pacemaker
*** : Replaced prosthetic aortic valve

stenosed LMCA and it was adequately postdilated using a 6.0 × 20 mm Maverick-XL balloon catheter (SciMed, Boston Scientific). After this stenting, however, her stented LMCA restenosed about every 3 months, and conventional or cutting balloon angioplasty was performed to compress the intrastent neointima to the exterior of the stent struts on all such occasions. She underwent a total of 8 transcatheter target lesion revascularizations.

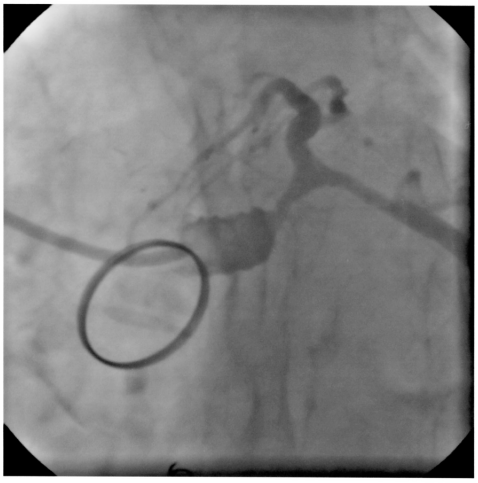

Figure 2. Preprocedural spider view of left coronary angiography: left main coronary artery (LMCA) was severely stenosed.

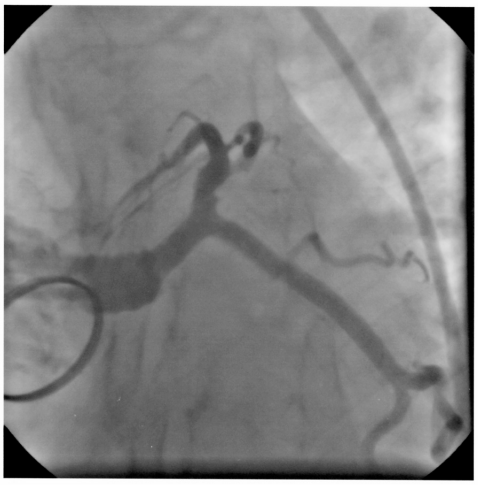

Figure 3. Postprocedural spider view of left coronary angiography: LMCA bifurcation lesion was dilated with the culottes stenting technique using 2 Cypher stents.

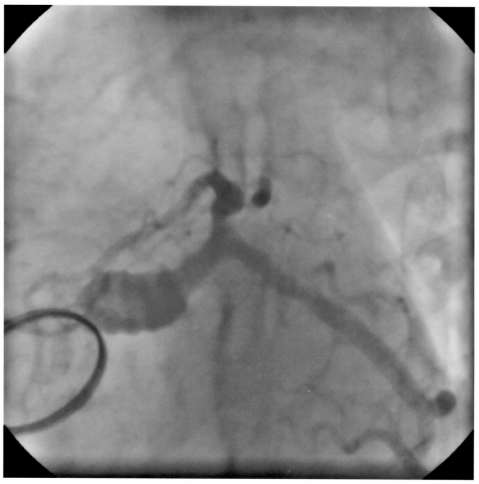

Figure 4. Chronic phase angiography of left coronary artery: No restenosis was observed.

The Cypher stent (Johnson & Johnson, Cordis), approved in Japan in August 2004, was used to treat her. When she was admitted to our hospital, she again complained of chest pain on effort and CAG revealed severe narrowing had reappeared at her LMCA (Figure 2). We electively planned to dilate her LMCA lesion with the culottes stenting technique by using 2 Cypher stents and electively treated her 3 days later.[2] After the LMCA was engaged with a 7Fr JL4.0ST Brite-tip guiding catheter (Johnson & Johnson, Cordis) via her right femoral artery, a 0.014" Runthrough-NS floppy guidewire (Terumo) and a 0.014" Hi-torque balance middleweight guidewire (Guidant) easily crossed the lesion toward her LAD and left circumflex coronary artery (LCX), respectively. Preprocedural intravascular ultrasonography (IVUS) with a 2.5Fr Atlantis-SR Pro imaging catheter (SciMed, Boston Scientific) was performed. IVUS images revealed that the previously implanted S670 stent was fully expanded and the stent diameter was about 5.8 mm, and that the intrastent lumen was occupied by a massive amount of hyperplastic neointima. Without predilatation, a 3.5 × 23 mm Cypher stent was delivered and placed onto the native LMCA extending over her proximal LCX. The Hi-torque balance middleweight guidewire inserted into her LCX was partially removed and advanced to her LAD through the stent cell. The Runthrough-NS floppy guidewire was completely removed and advanced to her LCX. We advanced a 3.0 × 20 mm Maverick-2 balloon catheter (SciMed, Boston Scientific) along the Hi-torque balance middleweight guidewire, positioned it across the stent cell, and dilated it to expand the cell. Next, we delivered a 3.5 × 18 mm Cypher stent across the expanded stent cell toward the LAD and placed it onto her native LMCA extending over the proximal LAD. Again, the Hi-torque balance middleweight guidewire inserted into the LAD was partially removed and advanced to the LCX through the stent cell. The Runthrough-NS floppy guidewire was completely removed and advanced to her LAD. Then, we again advanced the previously used 3.0 × 20 mm Maverick-2 balloon catheter toward the LCX, positioned it across the stent cell, and dilated it. In order to perform adequate postdilatation with an alternative kissing balloon technique, we advanced a 5.0 × 20 mm Maverick-XL balloon catheter and dilated it within her LMCA, proximal LAD, and proximal LCX. Finally, full expansion of the 2 Cypher stents was confirmed with both CAG and IVUS to complete the procedure (Figure 3).

She was discharged the day following the procedure and has not complained of any angina since. Another CAG performed 6 months after the procedure showed no restenosis of the stented segments (Figure 4).

DISCUSSION

Takayasu's arteritis or pulseless disease is a chronic and progressive inflam-

matory vasculitis that usually occurs in young women and is characterized by stenosis or obliteration of large and medium sized arteries, and its early morbidity and/or mortality results from ischemia of vital organs.[3,4] Coronary artery disease is not a rare involvement of arteritis and its incidence has been reported to be 9-10%,[4,5] however, the ratio is usually derived from autopsy studies. The actual clinical manifestation appears to be relatively unappreciated because coronary artery disease is not evident in most cases until the occurrence of angina or myocardial infarction.[5,6] Matsubara and colleagues classified coronary lesions involved in arteritis into 3 types on the basis of pathological features and reported that stenosis or occlusion of the ostia and proximal segments of the coronary tree were most commonly seen.[5] In those diseased vessels, the extension of the inflammatory processes of the intimal proliferation and contraction of the fibrotic media and adventitia from the ascending aorta cause luminal narrowing.[5] In our patient, a significant narrowing occurred at her LMCA even after it was separated from her native ascending aorta due to the Bentall operation. The aforementioned classification of Matsubara, *et al* includes focal coronary arteritis, so-called skip lesions, therefore, her LMCA lesion possibly corresponded not to typical extending disease from the aorta but to the skip lesion.[5]

There have been few reports regarding transcatheter treatment of coronary artery disease resulting from arteritis. The most likely reason is that lesion location is usually ostial or proximal coronary segments like the LMCA, which are unsuitable for percutaneous angioplasty. Moreover, blood access sites would be limited in many cases if morbid changes occur at main branches of the aorta such as the iliac, subclavian, and innominate arteries. Aortic disease itself, like aneurysm, might disturb intraaortic catheter manipulation.

We encountered a young patient enduring considerable suffering who received LMCA stenting after a failed MIDCAB operation and many transcatheter revascularizations. We successfully treated her using sirolimus-eluting stents with the culottes stenting technique and obtained satisfactory chronic phase patency of the treated vessels. During the procedure, IVUS revealed that the stent deployed at her LMCA was fully expanded. That is, the stent prevented vessel contraction of the fibrotic media and adventitia. However, adequate steroid therapy unfortunately could not prevent intimal proliferation, which is one of the main causes of coronary narrowing resulting from arteritis.

Chronic phase restenosis is one of the weak points of percutaneous coronary intervention therapy. Every improvement in the interventional procedure and oral systemic pharmacological intervention have failed to achieve satisfactory results regarding the chronic phase patency of treated vessels after transcatheter coronary intervention. Recently, local drug delivery using drug-eluting stents has been proven to have encouraging results with respect to the prevention of instent

restenosis. Many investigators have already reported that SES, which is one of the better known drug-eluting coronary stents, is quite effective for not only the treatment of simple coronary narrowing like Stress/Benestent lesions but also that of complex stenosis like LMCA-stenosis, bifurcation lesions, and diffuse long stenosis.[7-15] However, all of these lesions treated in previous clinical studies were caused by atherosclerosis.

Takayasu's arteritis often afflicts young Asian women, and the number of white patients afflicted is small.[16] This most likely accounts for the reason there have been few reports on whether SES placement is effective against coronary artery stenosis caused by arteritis. As discussed by Furukawa and colleagues, the pathological features of diseased vessels in Takayasu's arteritis is predominant infiltration of various kinds of immunocytes.[17] It is well known that sirolimus has potent immunosuppressive effects although it was originally developed as an antibiotic agent. Therefore, this pharmacological function of SES brings excellent short- and mid-term vessel patency after its placement, however, it is unknown whether this good mid-term finding can extend to a long-term effect after sirolimus coated on the stent struts is completely diffused in the same way as its placement to treat simple atherosclerosis.

We have described a case of LMCA disease resulting from arteritis, and SES was quite efficacious against the intimal hyperplasia. However, long-lasting observation is essential since most patients with Takayasu's arteritis are young and the arteritis is a progressive disease in nature. We are able to conclude, however, that SES placement is a potent candidate for revascularization whose aim is to free arteritis patients from myocardial ischemia.

REFERENCES

1. Piehler JM, Pluth JR. Replacement of the ascending aorta and aortic valve with a composite graft in patients with nondisplaced coronary ostia. Ann Thorac Surg 1982; 33: 406-9.
2. Lefevre T, Louvard Y, Morice MC, *et al*. Stenting of bifurcation lesions: classification, treatments, and results. Catheter Cardiovasc Interv 2000; 49: 274-83.
3. Hodgins GW, Dutton JW. Transluminal dilatation for Takayasu's arteritis. Can J Surg 1984; 27: 355-7.
4. Suzuki H, Daida H, Tanaka M, *et al*. Giant aneurysm of the left main coronary artery in Takayasu aortitis. Heart 1999; 81: 214-7.
5. Matsubara O, Kuwata T, Nemoto T, Kasuga T, Numano F. Coronary artery lesions in Takayasu arteritis: pathological considerations. Heart Vessels Suppl 1992; 7: 26-31.
6. Thomas D, Dubourg O, Bletry O, *et al*. Coronary involvement in Takayasu's disease. Apropos of 3 cases, of which 2 were surgically treated, and review of the literature. Arch Mal Coeur Vaiss 1984; 77: 386-96. (Review)(French)
7. Morice MC, Serruys PW, Sousa JE, *et al*. Randomized Study with the Sirolimus-Coated Bx Velocity Balloon-Expandable Stent in the Treatment of Patients with *de Novo* Native Coronary Artery Leions. A randomized comparison of a sirolimus-eluting stent with a standard stent for coronary revascularization. N Engl J Med 2002; 346: 1773-80.

8. Moses JW, Leon MB, Popma JJ, *et al*. Sirolimus-eluting stents versus standard stents in patients with stenosis in a native coronary artery. N Engl J Med 2003; 349: 1315-23.
9. Schofer J, Schluter M, Gershlick AH, *et al*. Sirolimus-eluting stents for treatment of patients with long atherosclerotic lesions in small coronary arteries: double-blind, randomized controlled trial (E-SIRIUS). Lancet 2003; 362: 1093-9.
10. Arampatzis CA, Lemos PA, Hoye A, *et al*. Elective sirolimus-eluting stent implantation for left main coronary artery disease: six-month angiographic follow-up and 1-year clinical outcome. Catheter Cardiovasc Interv 2004; 62: 292-6; discussion 297.
11. Colombo A, Moses JW, Morice MC, *et al*. Randomized study to evaluate sirolimus-eluting stents implanted at coronary bifurcation lesions. Circulation 2004; 109: 1244-9.
12. Degertekin M, Arampatzis CA, Lemos PA, *et al*. Very long sirolimus-eluting stent implantation for *de novo* coronary lesions. Am J Cardiol 2004; 93: 826-9.
13. Schampaert E, Cohen EA, Schluter M, *et al*. The Canadian study of the sirolimus-eluting stent in the treatment of patients with long *de novo* lesions in small native coronary arteries (C-SIRIUS). J Am Coll Cardiol 2004; 43: 1110-5.
14. Chieffo A, Stankovic G, Bonizzoni E, *et al*. Early and mid-term results of drug-eluting stent implantation in unprotected left main. Circulation 2005; 111: 791-5.
15. Park SJ, Kim YH, Lee BK, *et al*. Sirolimus-eluting stent implantation for unprotected left main coronary artery stenosis: comparison with bare metal stent implantation. J Am Coll Cardiol 2005; 45: 351-6.
16. Amano J, Suzuki A. Coronary artery involvement in Takayasu's arteritis. Collective review and guideline for surgical treatment. J Thorac Cardiovasc Surg 1991; 102: 554-60. (Review)
17. Furukawa Y, Tamura T, Toma M, *et al*. Sirolimus-eluting stent for in-stent restenosis of left main coronary artery in Takayasu arteritis. Circ J 2005; 69: 752-5.