Percutaneous Management of a Coronary Bifurcation Aneurysm

with Mesh-Covered Stents and the Simultaneous Kissing Stent Technique

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A 63-year-old man was admitted with a clinical diagnosis of acute coronary syndrome (non-ST-segment elevation), characterized by regional hypokinesia of the left ventricular posterior and lateral walls and by positive cardiac biomarkers. The coronary angiogram showed a 12.5-mm-diameter aneurysm with a mural thrombus and possible distal embolism to the bifurcation of the left circumflex coronary artery and the 2nd marginal branch.

The aneurysm was managed percutaneously by implanting 2 mesh-covered stents in accordance with the "simultaneous kissing stent" technique. Follow-up angiography and optical coherence tomography at 5 postprocedural months documented complete sealing of the aneurysm and diffuse in-stent restenosis. No sign of ischemia occurred during the subsequent follow-up. (*Tex Heart Inst J* 2015;42(4):397-9)

The development of coronary artery aneurysms is unpredictable: quiescence, progressive enlargement,¹ thrombus formation, embolism,² and sudden rupture³ are among the possibilities.

Case Report

In 2013, a 63-year-old man, with hypertension and dyslipidemia, was admitted under a clinical diagnosis of acute coronary syndrome (non-ST-segment elevation), characterized by regional hypokinesia of the left ventricular posterior and lateral walls and by positive cardiac biomarkers.

The coronary angiogram showed a large aneurysm with a mural thrombus at the bifurcation of a dominant left circumflex coronary artery (LCx) and a sizable 2nd marginal branch (OM2) (Fig. 1). Intravascular ultrasonography (IVUS) confirmed the presence of a true aneurysm: maximum diameter, 12.5 mm; total length (with transitions), 39 mm; proximal reference diameter, 5.5 mm; and distal reference diameters, 4 mm in the LCx and 4.5 in the OM2.

The patient's clinical presentation with an apparent acute coronary syndrome, his negative history for Kawasaki disease (or other forms of arteritis), and the 3-layered wall pattern upon IVUS imaging, led us to speculate that the most likely pathogenesis was atherosclerotic positive remodeling with thromboembolism. A moderate hazy lesion in the proximal OM2, possibly a remnant of a stratified thrombus (Fig. 1), was supportive of that hypothesis. After discussion of the case with other members of the cardiovascular team, we excluded medical management with a vitamin K antagonist or antiplatelet agents. Because the progression and clinical consequences of a large aneurysm are unpredictable and potentially catastrophic, we instead chose percutaneous management with 2 mesh-covered stents.

At the time of the intervention, the patient was already on double antiplatelet therapy (clopidogrel 75 mg and aspirin 100 mg orally). After inserting the sheaths, we administered unfractionated heparin (100 IU/kg). Two 6F extra-backup guiding catheters were then advanced through the right femoral artery and the right radial artery. After wiring both branches, we advanced—to the bifurcation—2 polyethylene terephthalate (PET) MicroNet™-covered MGuard™ 39 × 3.5-mm stents (InspireMD,

Key words: Acute coronary syndrome; bifurcation aneurysm; blood vessel prosthesis implantation; coronary aneurysm/diagnosis/therapy; disease progression; percutaneous coronary intervention/methods; stents

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Fig. 1 Coronary angiogram (anteroposterior 40° caudal view) of the left coronary artery shows a large coronary aneurysm involving the bifurcation of a dominant left circumflex coronary artery. A hazy lesion of moderate size is visible in the proximal marginal branch (arrow).

Supplemental motion image is available for Figure 1.

Fig. 2 Coronary angiogram (anteroposterior 40° caudal view) shows the left coronary artery after mesh-covered stent implantation by means of the simultaneous kissing stent technique. The coronary aneurysm was not acutely sealed; slow flow and incomplete opacification of the cavity are shown.

Ltd.; Tel Aviv, Israel) and we inflated the stents to a pressure of 14 atm, in accordance with the simultaneous kissing stent (SKS) technique. We reconstructed the bifurcation and shifted a neo-carina proximally, but we did not seal the aneurysmal cavity immediately—in fact, late and incomplete opacification of the cavity by contrast medium was visible on the final angiogram (Fig. 2). The patient was discharged from the hospital on prolonged double antiplatelet therapy.

When a coronary angiogram was performed 5 months later (upon the recurrence of effort angina), the aneurysmal cavity was seen to be completely sealed; however, a tight, diffuse in-stent restenosis was visible in both the LCx and the OM2 (Fig. 3). After predilation with a 3-mm balloon, we obtained an optical coherence tomographic (OCT) scan. The OCT scan confirmed that the stents were well apposed and were diffusely covered by neointimal hyperplasia, which is characteristic of in-stent restenosis. The neointimal hyperplasia spared only a few millimeters of the proximal neo-carina in the mid LCx. Four drug-eluting stents were needed to cover the entire length of the lesion: two 2.75 × 24-mm everolimus-eluting PROMUS Element™ stents (Boston Scientific Corporation; Natick, Mass) were deployed at pressures of 24 atm in the distal LCx and the OM2 branch; then two 3 × 24-mm PROMUS Element stents were deployed at pressures of 20 atm a few mm proximal to the edge of the MGuard stents, in accordance with the SKS technique. The final angiogram showed

Fig. 3 After 5 months, coronary angiogram (anteroposterior 40° caudal view) shows tight, diffuse, in-stent restenosis in the left coronary artery.

a good procedural result, despite the compromise of a small bifurcation branch of the OM2 (Fig. 4). The final OCT scan confirmed full apposition of the stents and good reconstruction of the neo-carina. The patient had an asymptomatic increase of cardiac biomarkers, which probably arose from the OM2 side-branch compromise. He was discharged from the hospital on the 2nd day

Fig. 4 Final coronary angiogram (anteroposterior 40° caudal view), after drug-eluting stent implantation, shows that a small marginal bifurcation branch was compromised after stent implantation (arrows).

Supplemental motion image is available for Figure 4.

after the procedure. Eleven months after discharge, the patient was on double antiplatelet therapy, was free of angina, and completed a stress test with negative results.

Discussion

To our knowledge, this is the first report in which a bifurcation coronary aneurysm was successfully managed percutaneously with the implantation of 2 PET-covered MGuard stents. Furthermore, we believe this to be the first description of the SKS technique in which covered stents were used to seal a bifurcation aneurysm. The percutaneous management of bifurcation aneurysms is particularly challenging, because the goal should be complete obliteration of the cavity, without compromise of the side branch. The use of a single stent-graft can lead to impaired flow in the side branch, while the retention of a connection between the side branch and the aneurysm can maintain a continual supply of blood and pressure to the cavity. On the other hand, stent-grafts are not suitable for the usual double-stent techniques used for bifurcations (T-stenting, or culotte or crush techniques) that require crossing of the stent struts. To our knowledge, only a single case of percutaneously managed bifurcation aneurysm⁴ has been reported: in that instance, access to the side branch was achieved via a handmade hole in the polytetrafluoroethylene-covered JOSTENT® GraftMaster (Abbott Vascular, a division of Abbott Laboratories; Abbott Park, Ill), through which a 2nd conventional stent was deployed.

The disadvantages of this technique appear to be two in number: not only is the placement of an uncovered stent in the side branch technically more demanding than the SKS, but it leaves an area of communication that might prevent obliteration.

The MGuard stent has a stainless-steel platform wrapped by an expandable MicroNet of knitted PET fiber with a pore size of 150 to 180 μm . This device is not approved by the U.S. Food and Drug Administration but is available in Europe with indications for use in cases of acute myocardial infarction or saphenous vein graft lesions. A single case has been reported⁵ in which the MGuard stent was used to treat a coronary aneurysm. This device did not confer immediate sealing, yet we expected the interposition of the MicroNet between the aneurysm and the lumen to cause stagnant flow, cavity thrombosis, and, after a time, complete obliteration. Delayed sealing should not be a concern, because progression of the aneurysm is usually slow,¹ and there is the additional option of coil embolization with a microcatheter (through the stent meshes), should the open cavity persist.

In summary, we have found that the percutaneous management of a large aneurysm involving a bifurcation is feasible via the SKS technique, with the use of 2 PET mesh-covered MGuard stents. This approach led to a delayed, yet complete, sealing of the aneurysmal cavity and to reconstruction of the bifurcation.

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