Early Aneurysm Formation After Everolimus-Eluting Stent Implantation

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A 65-year-old woman with hypertension and dyslipidemia presented with rest chest pain in the setting of 2 mm ST depression in ECG leads V3-V6 and a troponin T level (TnT) of 0.92 ng/mL (normal, <0.08 ng/mL). Emergent cardiac catheterization, performed for the non-ST elevation myocardial infarction (NSTEMI), revealed a 60% proximal left anterior descending artery (LAD) bifurcation lesion involving an 80% lesion in the first diagonal branch (D1) and a 90% first obtuse marginal artery (OM1) lesion (Figure [A]). Fractional flow reserve (FFR) of the LAD was 0.78, and the LAD was successfully treated with a bifurcation approach using a 2.75×12 mm everolimus-eluting stent (EES, Xience Prime, Abbott Vascular, Redwood City, CA) in the LAD and a 2.25×20 mm EES (Promus Element, Boston Scientific, Natick, MA) in D1; both deployed at 10 atmospheres (atm). The OM1 was treated with a 2.25×12 mm EES (Xience Prime) deployed at 10 atm. Full details of coronary interventions are available in the Data Supplement. There was no angiographic evidence of dissection or incomplete expansion after stent placement. She was discharged on dual antiplatelet therapy.

Seventeen days later, she presented again with chest pain, new anterior T-wave inversions on ECG, and TnT of 0.24 ng/mL. Catheterization showed aneurysm formation at the LAD and OM1 stent sites with occlusion of a distal LAD branch (Figure [B]), suggestive of localized hypersensitivity vasculitis with thrombus formation within the aneurysm and embolization to the distal LAD. There were no systemic signs of hypersensitivity such as fever, leukocytosis, or eosinophilia. Given the short time frame of aneurysm formation, coronary artery bypass surgery was performed with a left internal mammary artery to the LAD and saphenous vein grafts to D1 and OM1. The LAD, D1, and OM1 were ligated distal to the stents to prevent further thromboembolism from the aneurysms. On gross examination of the heart surface during surgery, the epicardial tissue and fat were noted to be highly inflamed, erythematous, and indurated. The patient returned for surveillance catheterization 6 weeks later. This demonstrated a slightly diminished LAD aneurysm and occluded D1 and OM1 with patent grafts (Figure [C]).

The patient presented again 4 months later with chest pain. ECG demonstrated ST depressions and T-wave inversions in V2-V6. TnT was 0.45 ng/mL. Emergent cardiac catheterization demonstrated significant enlargement of the LAD aneurysm. There were 90% in-stent restenoses proximal and distal to the aneurysm (Figure [D]). The D1 and OM1 remained occluded.

Although the polymers used for drug-delivery in drug-eluting stents (DES) are highly biocompatible, they can rarely incite a severe inflammatory reaction consisting of eosinophils and lymphocytes involving all 3 arterial layers, leading to aneurysm formation and significantly increasing the risk of stent thrombosis. Hypersensitivity vasculitis has been noted with first generation DES1–4; however, it has rarely been described after EES implantation3 and, to our knowledge, never within 3 weeks of implantation. As such, this would be the earliest report of aneurysm formation after EES implantation.

An allergic reaction to the stent metal is a possibility because the LAD and OM stents were made of cobalt chromium, and the stent without aneurysm formation (D1) was made of platinum chromium whereas both stents have the same biopolymer and medication. However, skin testing showed that the patient had no allergy to cobalt, chromium, or nickel. Platinum could not be tested. Other possible causes include stent malapposition, deep vessel wall injury, vasculitis, and bacterial arteritis. No angiographic evidence of malapposition or vessel wall injury after stent placement was noted. Additionally, the presentation of aneurysms in 2 arterial beds argues against a mechanical factor. There were no systemic signs of vasculitis or arteritis.

Hypersensitivity vasculitis is a rare complication of EES implantation. There is no known approach to anticipate or prevent this reaction; however, if observed, it should be promptly addressed because of its potential for serious and potentially fatal clinical consequences.

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References

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Figure. A, left, A left anterior oblique (LAO) caudal view of the left coronary artery (LCA) showing a bifurcation lesion with a 60% proximal left anterior descending artery (LAD) stenosis (arrowhead) and 80% first diagonal artery (D1) stenosis (black arrow). There is also a 90% stenosis in the first obtuse marginal (OM1) artery (white arrow). A, right, an LAO caudal view after successful treatment of these lesions with a bifurcation approach in the LAD (arrowhead) and diagonal (black arrow) and a single stent in the OM (white arrow). B, left, An LAO caudal view of the LCA during cardiac catheterization for a non-ST elevation myocardial infarction (NSTEMI) 17 days after initial stent placement. An aneurysm has developed over the site of the previously placed LAD (arrowhead) and OM (white arrow) stents. The right anterior oblique (RAO) cranial view (right) more clearly demonstrates the OM1 aneurysm (white arrow). There is evidence of embolism to the distal LAD with abrupt cutoff of the vessel before reaching the apex and occlusion of one of the apical branches (arrowhead). Six weeks after coronary artery bypass surgery, there is reduction in the size of the LAD aneurysm (C, left) and occlusion of the ligated LAD (black arrowhead), D1 (black arrow), and OM1 (white arrow) arteries. This is also seen on an RAO caudal view (C, right). Angiograms at presentation again 4 months later for an NSTEMI (D) show marked enlargement of the LAD aneurysm (left, black arrowhead) and proximal occlusion of the ligated D1 and OM1 (black and white arrows). The black arrowhead in D, right, shows a high grade restenotic lesion in the distal portion of the LAD stent. Videos and video legends of angiograms are available in the Data Supplement.
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SUPPLEMENTAL MATERIAL

VIDEO LEGENDS

Video 1A (left panel) demonstrates a left anterior oblique (LAO) caudal view of the left coronary artery (LCA) showing a bifurcation lesion with a 60% proximal left anterior descending artery (LAD) stenosis and 80% first diagonal artery (D1) stenosis. There is also a 90% stenosis in the first obtuse marginal (OM1) artery.

Video 1A (right panel) is a LAO caudal view following successful treatment of these lesions with a bifurcation approach in the LAD and diagonal and a single stent in the OM.

Video 1B (left panel) displays a LAO caudal view of the LCA during cardiac catheterization for a non-ST elevation myocardial infarction (NSTEMI) seventeen days after initial stent placement. An aneurysm has developed over the site of the previously placed LAD and OM stents.

Video 1B (right panel) displays a RAO cranial view which more clearly demonstrates the OM1 aneurysm seventeen days after initial stent placement. There is also evidence of embolism to the distal LAD with abrupt cutoff of the vessel prior to reaching the apex and occlusion of one of the apical branches.
Video 1C (left panel) demonstrates a LAO caudal view of the LCA six weeks after coronary artery bypass surgery. There is reduction in the size of the LAD aneurysm and occlusion of the ligated LAD, D1, and OM1 arteries.

Video 1C (right panel) also demonstrates occlusion of the ligated LAD, D1, and OM1 arteries following coronary artery bypass surgery.

Video 1D (left panel) demonstrates a LAO caudal view of the LCA at re-presentation 4 months later for a NSTEMI. There is marked enlargement of the LAD aneurysm and proximal occlusion of the ligated D1 and OM1.

Video 1D (right panel) shows a high grade, restenotic lesion in the distal portion of the LAD stent.
DETAILS OF CORONARY INTERVENTIONAL PROCEDURE

Obtuse Marginal Artery (OM1) Lesion

The OM1 was easily traversed with a 0.014” Terumo Runthrough® coronary wire (Terumo Cardiovascular Systems, Bridgewater, NJ). Three pre-dilations were performed across the lesion with a 2.0 x 12 mm balloon at 8 atmospheres (atm). A 2.25 x 12 mm everolimus-eluting stent was then deployed at 10 atm across the lesion (EES, Xience Prime®, Abbott Vascular, Redwood City, CA). Following stent deployment, there was a good angiographic result with no evidence of dissection or incomplete stent expansion.

Left anterior descending (LAD) artery / Diagonal (D1) artery bifurcation lesion

The LAD was easily traverse with a 0.014” Terumo Runthrough® coronary wire. A second 0.014” Terumo Runthrough® coronary wire was used to traverse the lesion in the diagonal artery. A 2.0 x 12 mm balloon was used to pre-dilate the diagonal lesion at 8 atmospheres. Next, a 2.75 x 15 mm EES (Xience Prime®) was deployed across the LAD lesion at 10 atmospheres. A 0.014” Abbott Hi-Torque Whisper coronary wire (Abbott Vascular, Redwood City, CA) was used to re-wire the diagonal artery through the LAD stent struts. The “jailed” Terumo Runthrough® coronary wire was removed from the diagonal artery. A 2.0 x 8 mm balloon was advanced along the diagonal wire across the stent struts and inflated to 12 atm. A 2.25 x 20 mm EES (Promus Element®, Boston Scientific, Natick, MA) was deployed in the diagonal vessel at 10 atm. This was followed by a “simultaneous kissing balloon” inflation in the LAD and D1 with a 2.5 x 15 mm balloon in the LAD and the 2.25 x 20 mm stent balloon in D1 at 8 atm. Following
stent deployment, there was a good angiographic result with no evidence of dissection or incomplete stent expansion.