

A Case of Percutaneous Coronary Intervention Using A Polytetrafluorethylene-Covered Stent For An Iatrogenic Pseudoaneurysm Of The Left Main Coronary Artery

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Abstract

A pseudoaneurysm of the Left Main Coronary Artery (LMCA) is rare. Serious adverse events, such as pseudoaneurysm rupture or myocardial infarction, can occur, although there are few reports of these. We report a case of Percutaneous Coronary Intervention (PCI) using a polytetrafluorethylene-covered stent for a chronic iatrogenic LMCA pseudoaneurysm and demonstrate the application of PCI in resolving such conditions. A 66-year-old man, who underwent stent implantation in his post-left anterior descending and right coronary arteries three years previously was admitted for an evaluation of coronary artery abnormalities on computed tomography. Angiography revealed an LMCA pseudoaneurysm. This pseudoaneurysm had been identified elsewhere two years earlier and was managed with optimal medication. Compared to that observed on the initial angiography, the pseudoaneurysm had expanded. Optical coherence tomography showed a saccular pseudoaneurysm. PCI was performed using Graftmaster® (Abbott Vascular, Tokyo, Japan), and resolution of the pseudoaneurysm was confirmed.

Keywords: Iatrogenic disease; Aneurysm false; Coronary vessels; Stents; Percutaneous coronary intervention

Introduction

Pseudoaneurysm of the Left Main Coronary Artery (LMCA) is rare [1]. Although there are only a few published case reports on this, pseudoaneurysm rupture or myocardial infarction could occur; thus, such lesions may represent a risk for serious adverse outcomes. Opinions differ on the appropriate treatment for dissecting pseudoaneurysms of coronary arteries.

Case report

A 66-year-old man complained of shortness of breath on exertion. Coronary computed tomography angiography (CCTA) was performed, which revealed an abnormal coronary artery, particularly arterial dissection of the LMCA. His medical history included a percutaneous coronary intervention (PCI) performed 3 years earlier on the right coronary artery (RCA) and left anterior descending artery (LAD).

He was admitted to our hospital for further examination. Prior to any procedures, the patient provided informed consent.

Surgical history included PCI (#1-3 Promus Premier® [Boston Scientific, Tokyo, Japan] 3.5×38 mm, XienceV® [Abbott Vascular, Tokyo, Japan] 3.0×38 mm) for angina in August 2014, PCI (#6 XienceV® [Abbott Vascular, Tokyo, Japan] 3.5×18 mm) in September 2014, and percutaneous transluminal angioplasty of the right external iliac artery (Omni-Link® [Abbott Vascular, Tokyo, Japan] 7.0×39 mm + 8.0×29 mm) performed for arteriosclerosis obliterans.

He had dyslipidaemia and a smoking history of 20 cigarettes daily for 42 years. Electrocardiogram (ECG) upon admission showed a pulse of 70 beats/min with sinus rhythm and no significant ST changes were noted. Plain chest radiographs at admission showed a cardiothoracic ratio of 48%, sharp costophrenic angles, and no apparent pulmonary abnormalities. Upon transthoracic echocardiography, cardiac contractility was maintained at 58.2% ejection fraction, with no valve disease or change in heart-wall motion.

A saccular pseudoaneurysm was noted in the LMCA on CCTA. Coronary angiography showed a saccular pseudoaneurysm extending from the proximal to the middle LMCA, and optical coherence tomography (OCT) revealed a lesion neck length of 6.6 mm, diameter of 2.7 mm, and width of 3.5 mm (including pseudoaneurysm 4.8×6.0 mm). The distal reference diameter from the lesion was 3.0×3.4 mm, and the proximal reference diameter was 3.3×5.4 mm. OCT of the pseudoaneurysm showed a defect in the coronary-artery vascular wall, which lacked all three layers (i.e., the tunica intima, media, and externa), which we deemed to be a pseudoaneurysm (Figure 1A,1B and 1C). The patient did not have any prior history of trauma to the chest.

The patient had undergone coronary intervention elsewhere in August 2014 and in September 2014, and follow up coronary angiography in March 2015, which, with the present coronary angiography, showed a clear trend of increasing size (Figure 2). Thus, on April 2017, PCI for this pseudoaneurysm using a polytetrafluoroethylene-covered stent was planned.

Since the Graftmaster® (Abbott Vascular, Tokyo, Japan) shortens when expanded, a stent with a radius of 3.5 mm and length of 16 mm were selected. After the stent was placed at 20 atm in the LMCA, it was expanded with the addition of an NCemerge® (Boston Scientific, Tokyo, Japan) (4.5×8 mm) non-compliant balloon to 24 atm, and angiography was performed. Dissection was noted at the distal edge of the stent. The Xience Alpine® (Abbott Vascular, Tokyo, Japan) (3.0×18 mm) was placed from the periphery of the Graftmaster® at 20 atm to cover the dissection and connect the stent previously placed in the anterior descending artery. The NCemerge® (4.0×8 mm) was then used to post-dilate inside the stent with 20 atm of pressure. The NCemerge® (4.5×8 mm) was post-dilated at 8 atm of pressure for the site where the stent and Graftmaster® overlap, and the NCemerge® (5.0×8 mm) was post-dilated to 20 atm of pressure at the proximal segment of the LMCA. Subsequently, OCT confirmed resolution of the pseudoaneurysm and favorable stent bonding. The Graftmaster® was shortened from 16 mm to approximately 13.3 mm, so as not to protrude into the aorta (Figure 3). Finally, the circumflex branch, high lateral branch, and other branches were confirmed to be free of obstruction (Figure 4). In addition to dual antiplatelet therapy, the patient was administered cilostazol for 3 months. Approximately 6 months after PCI, the patient did not exhibit any symptoms and is visiting our hospital as an outpatient.

Discussion

Treatments for coronary-artery pseudoaneurysm include drug therapy (e.g., antiplatelet therapy and anticoagulant therapy), PCI (stenting), or surgical treatment (coronary artery bypass surgery and ligation). Herein, we opted for PCI (stenting) because a clear trend of increasing size over time was observed, which we did not expect to respond to medication. Because of the LMCA's deep location, surgical treatment was not an option. Furthermore, the peripheral coronary artery did not have a significant stenosis or pathology, other than the lesion, and a bypass might have provoked flow competition.

The prevalence of coronary-artery pseudoaneurysms in cases undergoing coronary angiography is reportedly 0.2–10%. Such pseudoaneurysms occurred in the right coronary artery, left anterior descending branch, left circumflex branch, and left main trunk in 40.4%, 32.3%, 23.4%, and 3.5%, respectively, of all cases. They are classified by morphology as saccular or fusiform, and by vascular-wall integrity as true aneurysms, pseudoaneurysms, and dissecting aneurysms. Most cases are asymptomatic [1]. Coronary-artery aneurysms can have a wide variety of causes [1]. The present case is believed to be iatrogenic because the LMCA readily experienced vascular-wall damage from catheters and guide wires. The morphology was saccular for this pseudoaneurysm or dissecting aneurysm. The pseudoaneurysm formed after PCI in August 2014, and the patient's medical history did not include other diseases that could induce it.

The incidence of iatrogenic coronary-artery pseudoaneurysms during catheter examination or treatment is approximately 0.1%, and LMCA lesions occur in approximately 0.07% of cases. It occurs more frequently with percutaneous coronary angioplasty, and twice as often with coronary angiography [2]. Causes include anatomical anomalies in the coronary artery, atherosclerosis, rapidly injected contrast agent, catheter type (it is significantly more frequent with left Amplatz guiding catheters), improper catheter placement, and deep engagement during balloon drawing [3-6].

Treatments for coronary-artery pseudoaneurysm can be broadly divided into drug therapy (beta-blockers and anticoagulation to prevent progressive dissection and superimposed thrombus formation), percutaneous coronary angioplasty (stenting), and surgical treatment (coronary artery bypass grafting and ligation). Although pseudoaneurysm formation may be observed with drug therapy, there are also conceivable cases in which it is indicated, such as those with no ST-T changes in ECG, troponin-negative laboratory test results, no stenosis upon coronary angiography, or a coronary angiography grade of TIMI3 [7].

Although the Graftmaster® is not FDA approved for aneurysm repair, this case is an off-label clinical use. The Graftmaster® includes an expandable polytetrafluoroethylene body sandwiched between two stents. Notably, it has been shown to induce intra-stent thrombosis in approximately 15.6% of cases [8]. Therefore, follow-up includes careful monitoring for stent thrombosis in the LMCA.

Conclusion

Given the small number of cases and lack of established guidelines, each case requires individual attention when determining treatment. However, in the present case, PCI performed with the Graftmaster® enabled us to repair a coronary artery pseudoaneurysm. The Graftmaster® can be a useful tool to repair an LMCA pseudoaneurysm.

Compliance with Ethical Standards

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

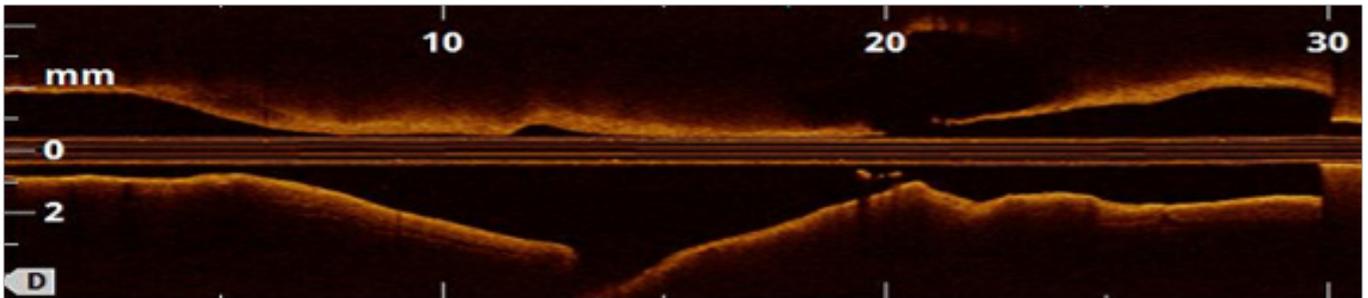


Figure. 1A: OCT revealed that vascular pseudoaneurysm neck had a lesion length of 6.6 mm, diameter of 2.7 mm, and width of 3.5 mm (including pseudoaneurysm 4.8×6.0 mm).

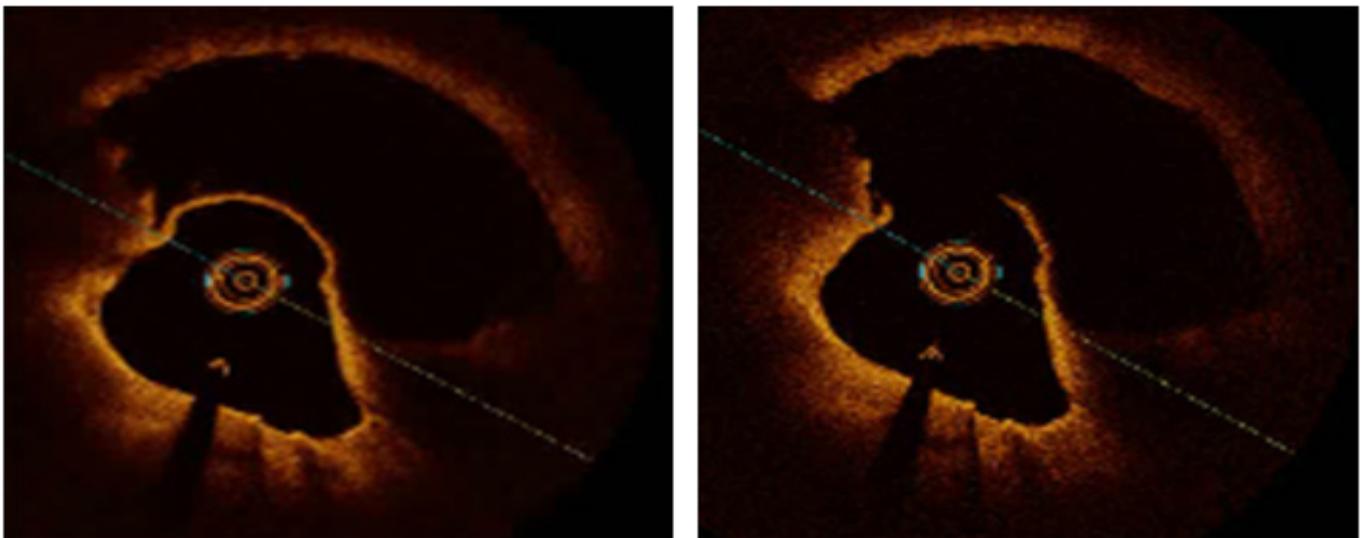


Figure. 1B, 1C: OCT of the pseudoaneurysm showed a break in a part of the coronary artery vascular wall, with the site lacking all three layers (i.e., the tunica intima, media, and externa). It was considered to be a pseudoaneurysm.



Figure. 2: The patient had undergone coronary intervention at another hospital on August 2014 and March 2015, and the present coronary angiography showed a clear trend of increasing size when compared to the sizes of the coronary artery pseudoaneurysm.

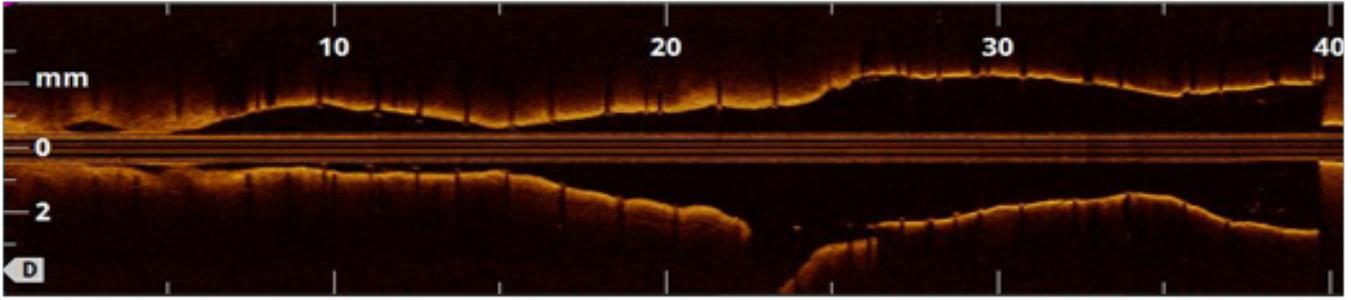


Figure 3: OCT was used to confirm resolution of the pseudoaneurysm and favourable stent bonding, and the Graftmaster® (Abbott Vascular, Co. Ltd., Tokyo, Japan) was shortened from the original 16 mm to approximately 13.3 mm so as not to protrude into the aorta.



Pre(AP-CRA)



Pre(RAO-CAU)



Post(AP-CRA)



Post(RAO-CAU)

Figure 4: Images before PCI (above) and after PCI (below). PCI utilizing the Graftmaster® (Abbott Vascular, Co. Ltd., Tokyo, Japan) enabled us to repair a coronary artery pseudoaneurysm.

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