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Case Report

A Case of Giant Saphenous Vein Graft Aneurysm Successfully Treated With Catheter Intervention

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The patient was a 67-year-old man who had undergone coronary artery bypass graft surgery using a saphenous vein graft (SVG) 22 years before. Computed tomography angiogram revealed a large aneurysm of the SVG (38 × 42 mm in diameter; 80-mm long) and total occlusion of the left anterior descending artery (LAD). We first performed percutaneous coronary intervention for chronic total occlusion of the native LAD with bi-directional approach via the SVG. One month later, we performed the trans-catheter embolization of the SVG and occluded the SVG using multiple coils. This case demonstrates that trans-catheter embolization after recanalization of native coronary artery is an effective strategy to treat an SVG aneurysm. © 2015 Wiley Periodicals, Inc.

Key words: saphenous vein graft aneurysm; trans-catheter embolization

INTRODUCTION

It has been reported that mild dilatation of saphenous vein grafts (SVG) occurs in 14% of the cases at 5–7 years after surgery [1]. However, giant aneurysm of the SVG is a rare complication of coronary artery bypass surgery, with an overall incidence of <1% [2,3]. Although SVG aneurysms are often incidentally identified on any type of imaging modality, there are some reports about cases of rupture [4], fistula formation with neighboring anatomy [5], and hemodynamic compromise resulting from compression of adjacent cardiac and vascular structures [6]. Moreover, in-hospital mortality associated with giant SVG aneurysms was reported to be 15.7% [7].

SVG aneurysms have been generally treated by surgical repair, such as resection with or without bypass of the affected territory. Although the use of percutaneous treatment has been increasing recently [3,8–11], there is no report about SVG aneurysms treated with percutaneous revascularization followed by trans-catheter coil embolization. Here, we report the case of a giant SVG aneurysm that was successfully treated with catheter intervention.

CASE PRESENTATION

The patient was a 67-year-old man who had undergone coronary artery bypass graft surgery (CABG) using saphenous vein graft (SVG) 22 years before and had not presented chest symptoms during follow up. Transthoracic echocardiography demonstrated that the SVG aneurysm had been progressively enlarging at a rate of 5 mm within 6 months from July 2012 (Fig. 1A).

Additional Supporting Information may be found in the online version of this article.

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Conflict of interest: Nothing to report.

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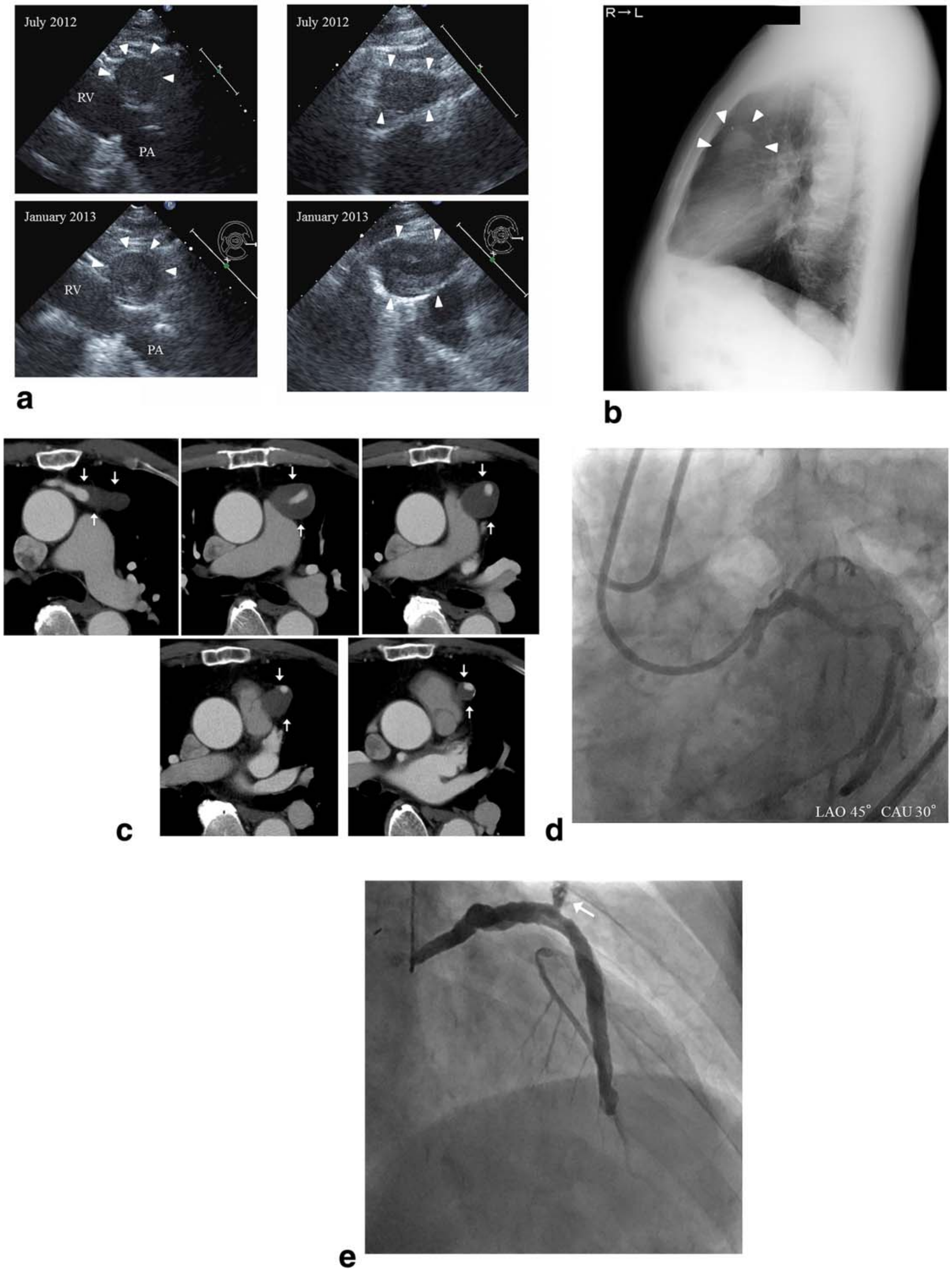

Fig. 1. Imaging findings before the procedure. A: Transthoracic echocardiography. White arrow-heads indicate the SVG aneurysm. Size of SVG aneurysm was enlarged within 6 months. B: Chest X-ray, lateral view. White arrow-heads indicate the mass-like shadow. C: Enhanced CT. Enhanced CT revealed a large aneurysm of the SVG (38 × 42 mm in diameter; 80-mm long) and graft patency. White arrows indicate the SVG aneurysm. D: Coronary angiogram of the left coronary artery at the left anterior oblique with caudal view. LAD was totally occluded from the orifice. E: Angiogram of the SVG. The white arrow indicates the leakage of contrast medium from the proximal portion of the SVG. RV, right ventricle; PA, pulmonary artery; SVG, saphenous vein graft; CT, computed tomography; LAD, left anterior descending artery.

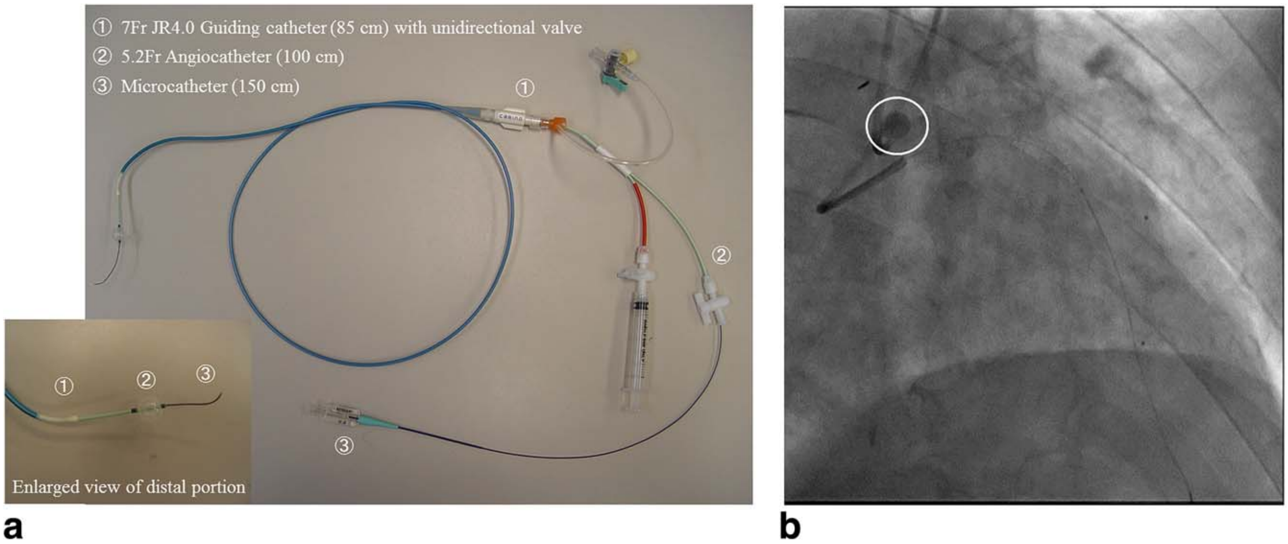

Fig. 2. Transcatheter embolization systems and its fluoroscopic image. A: Picture of trans-catheter embolization systems. A 5.2-Fr and 100-cm length angiocatheter was introduced into a 7-Fr JR4.0 shaped with 85-cm length guiding catheter via the unidirectional valve. Moreover, a microcatheter was introduced into the SVG through the 5.2-Fr angicatheter. During the coil-embolization, a balloon located at the tip of the angiocatheter was inflated. B: Fluoroscopic image. The white circle indicates the inflated balloon of the 5.2-Fr angiocatheter. During trans-catheter embolization, we inflated this balloon at the orifice of the SVG to shut off the blood flow from the aorta. JR, Judkins right; SVG, saphenous vein graft.

Besides, chest X-ray showed a mass-like shadow on the left side of mediastinum (Fig. 1B). Enhanced computed tomography (CT) revealed a large aneurysm of the SVG (diameter of aneurysm was 38 × 42 mm and its length was 80 mm) (Fig. 1C). The cardiac surgeon considered that it was necessary to perform surgical resection with revascularization to avoid fatal complications such as rupture of the aneurysm which could lead to sudden death. However, because the patient rejected re-thoracotomy, he was referred to our division to treat this SVG aneurysm with catheter intervention.

Coronary angiogram (CAG) demonstrated that the native left anterior descending artery (LAD) was totally occluded from the origin to its mid portion (Fig. 1D) and was perfused by the SVG (Fig. 1E). In addition, there was a large leakage of contrast medium from the proximal portion of the SVG (Fig. 1D). Left ventriculogram demonstrated that viability of the left ventricle was maintained.

Percutaneous Coronary Intervention for Chronic Total Occlusion of LAD

First, we performed percutaneous coronary intervention (PCI) for chronic total occlusion (CTO) of the native LAD with bi-directional approach via the SVG. An 8-Fr XB-LAD3.5 guiding catheter (Britetip, Cordis, NJ) was engaged into the left coronary artery and an 8-Fr Amplatz Left 1.0 with a short-tip guiding catheter (Britetip, Cordis) was engaged into the SVG. We introduced a floppy guidewire (SION blue, ASAHI INTECC, Aichi, Japan) and an intravascular ultrasound (IVUS) catheter (Volcano platinum, Volcano, San Diego, CA) into the high lateral branch and identified the orifice of the LAD. After that, we advanced a Crusade catheter (double lumen microcatheter) (Kaneka Medix, Osaka, Japan) along this floppy guidewire and penetrated the proximal cap of the LAD CTO using a guidewire with an intermediate tip load (3.5 g) and a tapered tip (Gaia Second, ASAHI INTECC) via the side hole of the Crusade catheter. After confirming the position of the Gaia Second guidewire using IVUS, we exchanged the microcatheter from the Crusade to a Corsair microcatheter (ASAHI INTECC) and advanced this guidewire to the more distal portion of the CTO. However, because the Gaia Second guidewire progressed into the subintimal space, we switched to the retrograde approach via the SVG. We penetrated the distal cap of the CTO using the Gaia First guidewire (tip load of 1.5 g and tapered tip) (ASAHI INTECC) and advanced this guidewire toward the antegrade guidewire with the support of the Corsair microcatheter. Finally, we could successfully recanalize the CTO lesion under IVUS-guided reverse controlled antegrade and retrograde subintimal tracking (CART) technique using a balloon catheter of 2.5 mm in diameter. We implanted two

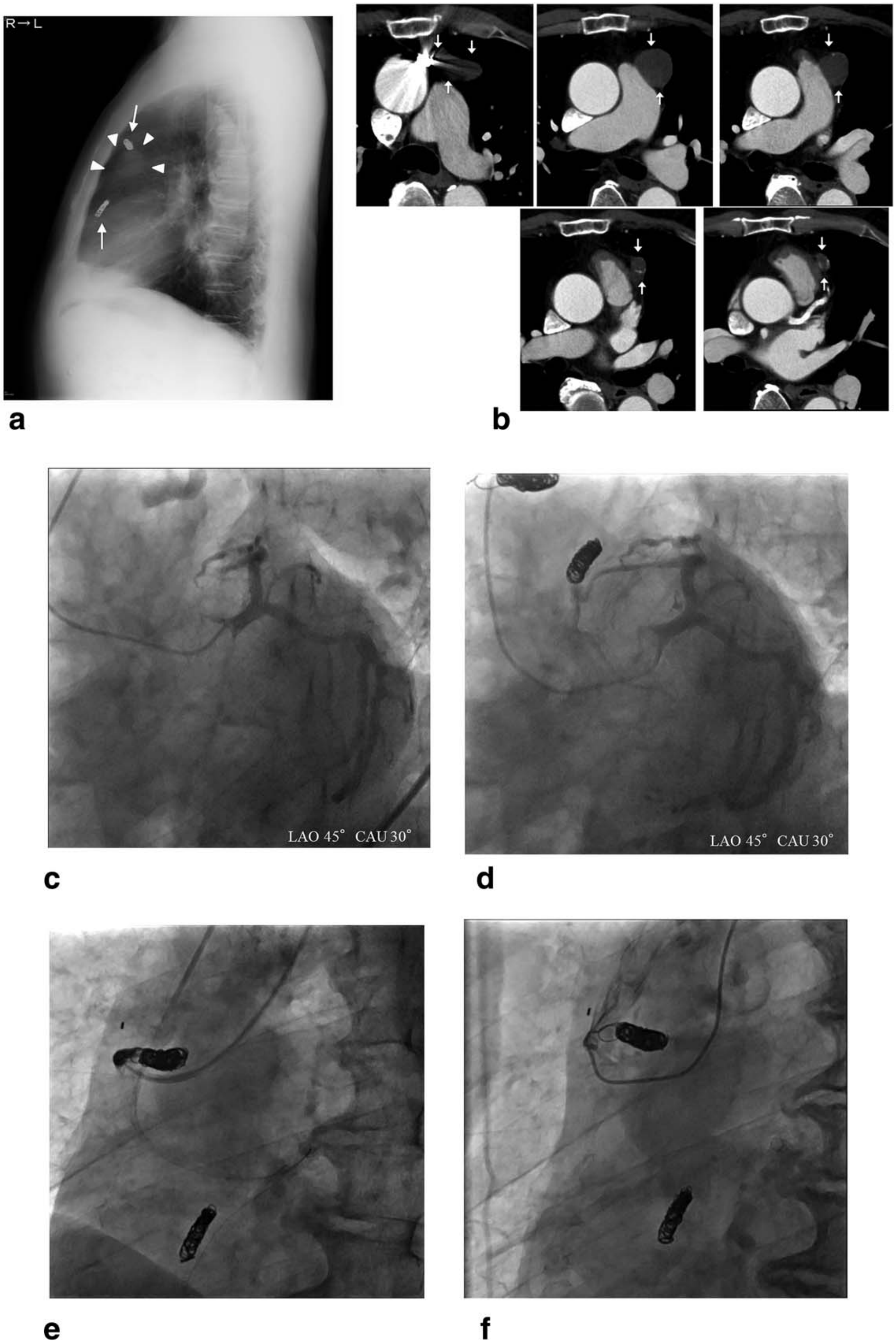

Fig. 3.

biolimus-eluting stents (Nobori, Terumo, Tokyo, Japan) from the mid portion of the LAD to the orifice of the left main trunk and performed simultaneously kissing balloon technique between the LAD and the left circumflex artery (LCx). The final CAG showed a well-expanded CTO lesion without disappearance of any branches (Fig. 3C).

Trans-Catheter Embolization for the SVG Aneurysm

One month after the PCI for the CTO lesion of the LAD, we performed trans-catheter embolization (TCE) for the SVG. At first, we deployed a drug-eluting stent (XIENCE PRIME, Abbott Vascular, Santa Clara, CA) for the distal portion of the LAD at the anastomosis of the SVG to avoid migration of coils from the SVG to the LAD. Then, we engaged a 7-Fr Judkins Right 4.0 guiding catheter of short length (85 cm) (Camino, GOODMAN, Aichi, Japan) to the SVG and inserted a 5.2-Fr angiocatheter (Selecon MP catheter II, Terumo Clinical Supply, Gifu, Japan), which had a balloon of 9.0 mm in diameter at the tip of the catheter, to the SVG via the 7-Fr guiding catheter (Fig. 2A). During the procedure, we inflated the balloon at the orifice of the SVG to shut off the blood flow from the aorta and to avoid drift of coils and distal embolism of the native LAD (Fig. 2B). A microcatheter (Renegade-18, Boston Scientific, Natick, MA) was introduced into the SVG through the 5.2-Fr angiocatheter and 4 coils (GDC-18 8 × 300 mm, GDC-18 5 × 200 mm, IDC-soft 3 × 100 mm, Vortex Diamond-18 4 × 41 mm, Stryker, Kalamazoo, MI) were deployed at the distal portion of the SVG via this microcatheter. We then deployed another 4 coils (GDC-18 12 × 300 mm, GDC-18 10 × 300 mm, IDC 8 × 200 mm, IDC-soft 5 × 120 mm, Stryker) at the proximal portion of the SVG. Finally, we achieved complete occlusion of the SVG (Fig. 3E, Supporting Information Movie).

Three months after the TCE, chest X-ray and CT demonstrated that the SVG had not recanalized and the size of the aneurysm had decreased (Fig. 3A and B). One year after the TCE, CAG revealed that the LAD maintained its patency (Fig. 3D) and the SVG had not recanalized (Fig. 3F).

DISCUSSION

A giant SVG aneurysm is a rare complication of CABG. Nevertheless, because of its high potential for morbidity and mortality, we should diagnose and treat this complication adequately. In our case, we could detect a progressively enlarging SVG aneurysm by multiple imaging modalities (echocardiography, CT, and CAG) and successfully treat it with catheter intervention.

SVG aneurysms generally develop more than 10 years after CABG [1]. A review article reported that only 4.2% of patients develop an SVG aneurysm within the first year after CABG, with 6.1% identified between 1 and 5 years, 21.2% between 5 and 10 years, and 68.5% at over 10 years after surgery [3]. Clinical symptoms associated with SVG aneurysms vary greatly among patients, and include chest pain (46.4%), shortness of breath (12.9%), myocardial infarction (7.7%) and so on. Nevertheless, one third of SVG aneurysms were discovered incidentally [3]. In the present case, we identified the SVG aneurysm coincidentally 22 years after CABG during follow up using echocardiography, CT, and CAG.

Adverse events associated with SVG aneurysms are mechanical complications such as compression, fistula formation to adjacent structures, or aneurysm rupture [3–6]. SVG aneurysms continue to increase in size once identified. Moreover, it has been reported that an event rate of mechanical complications was 33.3% even in 20 mm diameter of small SVG aneurysms [3]. Thus, to avoid these serious complications we should carefully follow the patients after CABG using SVGs, especially when several years have passed after the surgery, and it is desirable to perform some kind of treatment once SVG aneurysm is identified.

As for the management of SVG aneurysms, not only catheterization but also cross-sectional imaging modalities such as CT or magnetic resonance imaging are necessary because angiography cannot identify an

Fig. 3. Imaging findings after the catheter intervention. A: Chest X-ray, lateral view. Three months after the trans-catheter embolization. White arrows indicate the deployed coils. B: Enhanced CT. Three months after the trans-catheter embolization. Enhanced CT revealed that the SVG remained occluded and that the size of the SVG aneurysm had decreased (diameter was 30 × 32 mm). White arrows indicate the SVG aneurysm. C: CAG of the left coronary artery at the left anterior oblique with caudal view. Just after the percutaneous coronary intervention for chronic total occlusion of the LAD. CAG showed a well-expanded CTO lesion without disappearance of any branches. D: CAG of the left coronary artery at the left anterior oblique with caudal view. One year after the trans-catheter embolization. CAG revealed that the LAD maintained its patency. E: Angiogram of the SVG just after the TCE. The angiogram revealed that the SVG did not recanalize just after the TCE. F: Angiogram of the SVG 1 year after the TCE. The angiogram revealed that the SVG did not recanalize 1 year after the TCE. CT, computed tomography; SVG, saphenous vein graft; CAG, coronary angiogram; LAD, left anterior descending artery; TCE, trans-catheter embolization.

intraluminal thrombus and the size of the aneurysm or the interaction with adjacent structures cannot be evaluated. Strategy of treatment for SVG aneurysm has not been fully established because of small number of case reports about SVG aneurysm. SVG aneurysm had been generally treated with surgical repair [2,3]. Patients with other surgical indications (i.e. concomitant valvular disease or multiple territories requiring revascularization) or mechanical complications are recommended to undergo surgical treatment including aneurysm resection with subsequent bypass grafting [12]. In addition, for patients with patent affected grafts in whom the graft anatomy is not favorable for implantation of covered stents, surgical treatment should be selected. On the other hand, the number of patients subjected to percutaneous management for SVG aneurysm has been increasing recently [3,8–11]. In patients whose SVG remains patent and in whom continued antegrade blood flow through the SVG is necessary, percutaneous management with covered stents implantation is suitable [3]. However, fusiform aneurysms can pose a problem due to the limited length of coronary covered stents or vein-covered stents [8]. Also, in case of percutaneous treatment with peripheral covered stents [9], it is quite difficult to deliver the treatment system into the SVG and it involves many risks such as vessel rupture, distal embolism, and so on. The SVG aneurysm can be occluded by coil embolization [1,3,11] or vascular plugs [10] in patients whose SVG is occluded but shows unilateral patency and persistent flow into the aneurysmal segment or in whom the affected graft supplies a small territory. In our patient, the SVG remained patent and the territory of myocardium that was supplied by this SVG was broad. However, the SVG aneurysm was too large to be treated with the covered stents available in Japan. Furthermore, because CABG had been performed 22 years previously and his SVG became degenerated, the risk of thromboembolism or new aneurysm formation had to be considered even if the SVG could have been treated using covered stents. Moreover, he was still not so old, 67-year-old, and did not complicate other comorbidities. Thus, at first, we considered that a surgical repair combined aneurysm resection and bypass grafting was feasible for this patient. On the other hand, there was no severe stenotic lesion at his right coronary artery and LCx, and he rejected re-thoracotomy. In addition, re-do CABG has greater risks of operative mortality compared with primary CABG [13]. In consequence of a discussion among a heart team including cardiologists and cardiac surgeons of our institution, we decided to treat this patient with catheter intervention, which meant that we primarily recanalize the CTO of the native LAD with bi-directional approach via the SVG and subsequently perform TCE using endovascular coils. Nevertheless, if we could not recanalize the CTO of the native LAD, we adopted a surgical treatment as a backup plan and the patient consented to this strategy. Although we performed the TCE 1 month after the PCI with a view to thrombotic occlusion of the SVG after recanalization of the native LAD, it is feasible to perform recanalization and TCE consecutively within several days because the SVG maintained the patency even 1 month after the recanalization of the native LAD and this situation had a risk of occlusion of the native coronary artery due to competition of coronary blood flow. Moreover, simultaneous procedure of recanalization and TCE is unfavorable because acute stent thrombosis may occur. This is the first report of SVG aneurysm successfully treated by catheter intervention including PCI for the CTO of native coronary artery and TCE for the SVG aneurysm. In case of an SVG aneurysm that remains patent, percutaneous revascularization of native coronary artery followed by TCE is considered a useful strategy to treat an SVG aneurysm because the introduction of drug-eluting stent has resulted in improved patency of CTO in the chronic phase [14] and the initial success rate of PCI for CTO lesions has been improved with advancing of PCI techniques [15].

CONCLUSION

We successfully treated a patient with giant SVG aneurysm with two times of catheter intervention. TCE after revascularization with PCI for native coronary artery is one of the useful options of the treatment of SVG aneurysm.

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