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Case Report

Filter-based embolic protection device in saphenous vein graft percutaneous intervention: A case report ☆,☆☆

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ABSTRACT

Saphenous vein grafts (SVGs) are commonly used in coronary artery bypass graft (CABG) surgery patients. However, SVGs are prone to degradation and occlusion, resulting in poor long-term patency. Percutaneous coronary intervention (PCI) for SVG has been one of the options to treat SVGs disease despite its challenges. Embolic protection device (EPD) use along with proper stent and medications are considered to minimize complications in this procedure. A 61-year-old man, with 4-vessel coronary artery bypass using SVGs and left internal mammary artery (LIMA) 11 years ago, presented with chest pain for more than 3 months. Coronary angiography showed severe stenosis of the SVG to PDA with two lesions, chronic total occlusion in SVG to OM and LIMA to LAD, with patent SVG to D1. He was admitted for elective PCI using drug-eluting stents and distal embolic filter. There were no problems observed, and the procedure was completed with successful stenting in SVG to PDA without any complications. The patient was discharged on dual-antiplatelet therapy along with his previous medication history. PCI is preferred over repeated CABG in high-risk patients, and EPD should be considered whenever technically possible to minimize the risk of distal embolization and thereby improve outcomes in SVG PCI.

Introduction

Saphenous vein graft (SVG) is the most commonly used conduit to revascularize coronary artery disease during coronary artery bypass graft (CABG) surgery. However, it has poor long-term patency, leading to SVG diseases and becoming one of the major challenges in its treatment [1]. Several studies have reported that as many as 2%-20% of SVGs are occluded in the first year after CABG surgery, and the late graft failure 10 years

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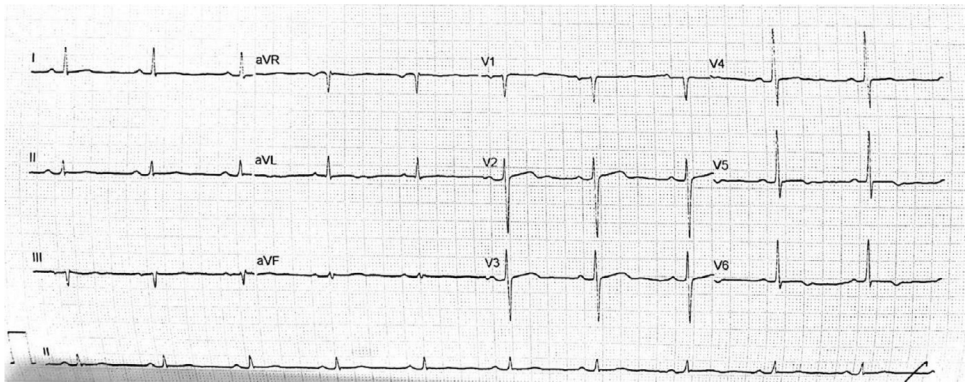

Fig. 1 – Electrocardiography during hospitalization showed normal sinus rhythm without sign of ischemia.

after CABG surgery is estimated as high as 40%-50% [2]. SVGs disease is characterized by thick walls and weak lesions that considerably enhance the risk of thrombosis prone to lumen occlusion. This might be clinically manifested as recurrent angina by patients. Although some studies favor the treatment of native coronary artery disease, the occurrence of severe calcification or chronic total occlusion is often hindering the intervention. As a result, SVG percutaneous coronary intervention (PCI) remains as a preference strategy for SVG failure revascularization [3]. Notwithstanding, the degenerative nature of SVGs disease poses higher risk of distal embolization which leads to periprocedural myocardial infarction (MI) and no-reflow phenomenon [4]. Therefore, the rationale for using an embolism protection device (EPD) is to improve SVG PCI outcomes by reducing the risk of distal embolism [5]. Here, we describe a case of multiple SVG graft occlusions treated using EPD in saphenous vein percutaneous intervention.

Case presentation

A 61-year-old Asian man was referred to cardiology outpatient clinic presenting with recurrent typical chest pain for more than 3 months and relief during rest. Previous medical history consisted of hypertension for 19 years, type 2 diabetes mellitus for 15 years, dyslipidemia, and pertinent previous 4-vessel CABG 11 years ago. Previous medications used was insulin (Tresiba) 14 IU q.d., clopidogrel 75 mg q.d., aspirin 100 mg q.d., simvastatin 20 mg q.d., amlodipine 5 mg q.d., bisoprolol 5 mg b.i.d., and allopurinol 300 mg q.d.

The patient's vital signs and general physical examinations were within normal limits. Electrocardiography findings showed normal sinus rhythm (Fig. 1). Laboratory examination showed normal complete blood counts. Renal function test and electrolyte results are as follows: BUN 43 mg/dL, creatinine 1.7 mg/dL, sodium 136 mmol/L, chloride 90 mmol/L, and potassium 4.2 mmol/L. His multisliced computed-tomography scan revealed severe stenosis of the SVG to posterior descending artery (PDA) with 2 lesions, chronic total occlusion SVG to D1, SVG to obtuse marginal (OM) patent, and left internal mammary artery (LIMA) to left anterior descending (LAD) are all occluded.

The patient was referred to cardiac catheterization room for coronary angiography. The results of coronary angiography using JL 4.0 5F and JR 4.0 5F catheters are demonstrated in Figure 2: (1) left main coronary artery: occluded; (2) LAD: chronic total occlusion in proximal LAD, distal LAD filled with LIMA and RPDA; (3) left circumflex (LCx): chronic total occlusion in proximal LCx, (4) right coronary artery (RCA): 90% stenosis of the proximal RCA, RPL mild disease, RPDA filled from SVG-PDA. SVG graft to D1: patent with grade 3 collateral from the D1 to the distal LCx. SVG graft to OM: occluded; SVG graft to PDA: proximal 70%-80% stenosis, 90% stenosis with clot in the middle SVG to the PDA. The patient was diagnosed with triple vessel disease and graft disease (SVG to OM and SVG to PDA) post-CABG.

PCI in SVG to PDA was then performed (Figs. 3A and B, Supplementary movies S1 and S2). Guiding catheter JR 3.5/6F was used to cannulate SVG to PDA ostium. FilterWire EZ 3.5/5.5 mm was delivered to the distal end of SVG to PDA. Subsequently, Angiolite 4.0/29 mm sirolimus-eluting stent was deployed in mid SVG to PDA and dilated up to 12 atm. We discovered that debris on the filter causes thrombolysis in myocardial infarction (TIMI) flow I after the stent was successfully implanted. Orsiro 3.5/26 mm sirolimus-eluting stent was implanted on the proximal SVG to PDA and dilated up to 18 atm. Angiography evaluation was conducted after the stents were successfully placed. Filterwire was removed, and TIMI flow 3 was observed (Fig. 3C). Neither complications nor problems were observed during the procedure.

Subsequently, the patient was transferred to intensive cardiovascular care unit for post-PCI care. The patient was discharged 1 day after PCI and continues the previous medications along dual-antiplatelet therapy: aspirin 100 mg q.d. and ticagrelor 90 mg b.i.d. The patient had an uneventful recovery and remained symptom-free during 3 months of follow-up.

Discussion

Saphenous vein remains the most frequently used vessel for CABG, although its long-term patency has been reported to be unsatisfactory. SVG damage and occlusion are caused by various reasons that need revascularization. Pre-

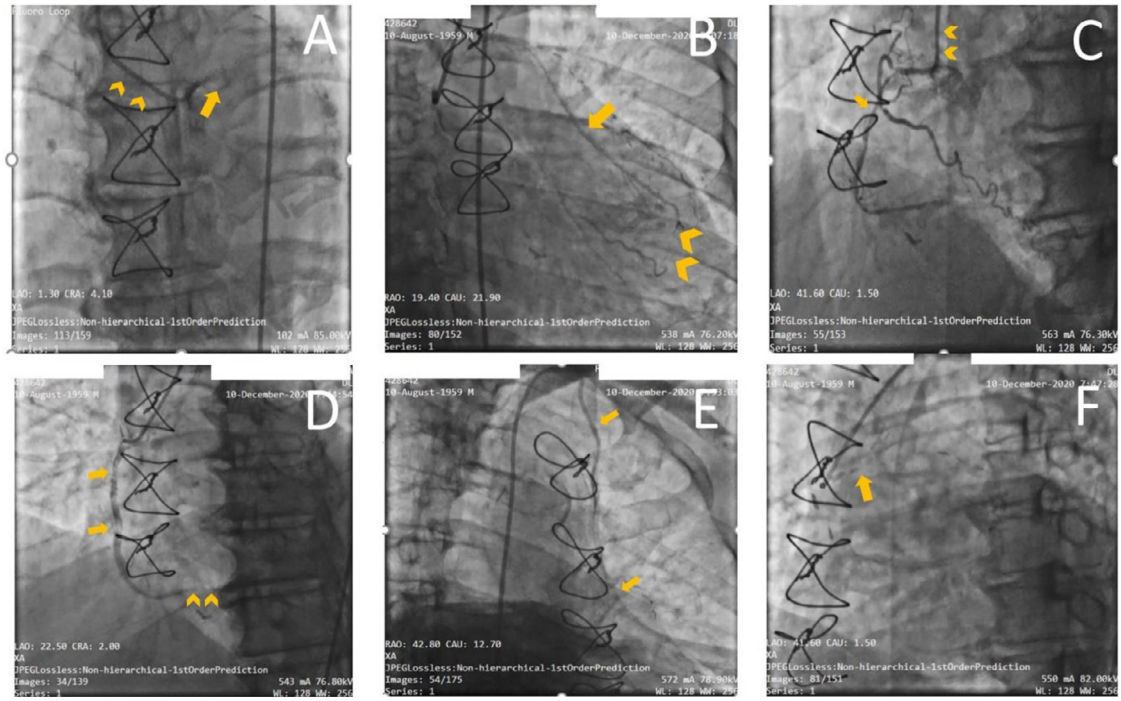

Fig. 2 – Diagnostic coronary angiography via a JL catheter (arrowheads, panel A) with left main coronary artery occluded (arrows, panel A). D1 branch is filled from SVG to D1 graft (arrow, panel B) with grade 3 collateral from the D1 to the distal LCx (arrowheads, panel B). The results of coronary angiography via a JR catheter (arrowheads, panel C) was 90% stenosis of the proximal RCA (arrow, panel C). RPDA filled from SVG to PDA (arrowheads, panel D). About 70%-80% stenosis of the proximal SVG graft to PDA and 90% stenosis with clot in the middle SVG to the PDA (arrows, panel D). Proximal LAD and LCx were chronic total occlusion with distal LAD is filled from LIMA graft to LAD (arrows, panel E). SVG to OM occluded (arrow, panel F). Coronary angiography conclusion was triple vessel disease 11 years after CABG with graft disease (SVG to OM and SVG to PDA); JL: Judgkin Left, JR: Judgkin Right.

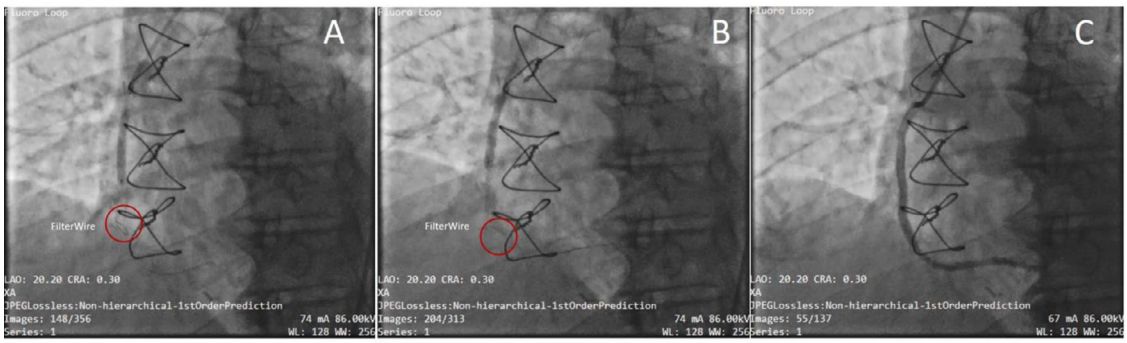

Fig. 3 – Lesion at mid part of SVG graft to PDA was stented with Angiolite – Sirolimus drug-eluting stent 4.0/29 mm up to 12 atms (A). Lesion at proximal part of SVG graft to PDA was stented with ORSIRO 3.5/26 mm up to 18 atms (B). FilterWire EZ was placed more than 3 cm at the distal of the lesion to avoid interference during stent placement. Thrombolysis in myocardial infarction-3 flow was noted after the procedure (C).

vious reports suggest around 10%-15% of SVGs are blocked within 1 year, and 50% fail after 10 years [2,6]. SVG failure occurs in the first 12-18 months following CABG due to platelet aggregation, growth factor release, endothelial dysfunction, inflammation, cell accumulation, lower local fibrinolytic potential due to plasminogen activator-1 overexpression, and intimal hyperplasia [1,7]. Moreover, the increased pressure load caused by venous arterialization grafts also promotes the growth of neointimal and aggravates the development of atherosclerosis, making SVG lesions more unstable than native coronary artery lesions since they have thinner walls. This causes plaque embolization and platelet aggregation to become more prominent, especially during the SVG revascularization [1].

SVG intervention was associated with a greater risk of in-stent restenosis, target vessel revascularization (TVR), periprocedural MI, and in-hospital mortality than PCI of native coronary arteries. Previous studies found that lesion length has the strongest association with increased risk of major adverse cardiac events (MACE) in patients undergoing SVG intervention [8]. In a study of 34 patients with chronic total SVG occlusion, the effective stent recanalization rate was only 68% [9]. Thus, appropriate patient selection and the best approach to SVG revascularization are critically important because of the potentially serious implications [10].

In our reported cases, EPD using FilterWire EZ which acts as distal embolic filter was used to catch and collect plaque. Notwithstanding that SVG PCI procedure has higher risk of increase MACE incidences, several randomized trials have demonstrated the benefits of using this device. The Embolic Protection Transluminal with the FilterWire EZ Device in Saphenous Vein Grafts (BLAZE) registry shows a 97.8% success rate with EPD and a MACE of 6.7% for 30 days with no Q-wave MI [11]. Another observational study also mentioned that EPD used was associated with reduced unsuccessful intervention by 73% and 44% reduction in 30-day mortality [12]. Moreover, during 18 months of follow-up, there was no difference in terms of MACE incidence both in EPD groups and not [13]. However, these findings still need to be further investigated since several studies found conflicting results.

EPD should be employed in SVG intervention procedure whenever technically feasible according to the ACC/AHA/SCAI guideline recommendations to decrease the risk of distal embolization (recommendation class 2a) [14]. Nevertheless, the use of EPD was found to be limited and still underutilized. Several factor such as lack of familiarity of EPD, procedure prolongation, increased cost, operator dependent, and preference may discourage cardiologist interventionist [13]. In addition, selection of the patients that suitable for EPD also plays a role. Older male patients with longer and older graft were more likely to receive EPD [13]. Furthermore, EPD usually only used in patients with complex SVG anatomy, it is more likely that they will be associated with an increased rate of complications [3].

Multipurpose catheters are often used for right coronary graft intervention, especially in steep and inferior graft take-off [1]. If the origin angel of the SVG to the right coronary artery is more horizontal, a Judkins right (JR) or Amplatz left (AL) catheter may be used. JR catheters can also be utilized to access the left coronary artery, particularly the aorta's horizontal take-off. Although predilation balloon angioplasty is commonly used in native vessel PCI, it may not be appropriate for SVG interventions. Direct stenting demonstrates more advantages in lower risk of distal embolism and debris trapping than predilation. A randomized-controlled trial study revealed that direct stenting has lower incidence of target vessel MI and stent thrombosis compared to pre-dilated balloon stent, although the incidences of TVR were similar between groups [15].

For optimal stent resistance and vascular patency, the appropriate stent option and medications is essential. According to our case, the patient received drug-eluting stent (DES) for SVG PCI. Previous studies comparing DES and bare-metal stent (BMS) in the SVG intervention found that DES was superior over BMS in terms of reducing short-term MACE, total lesion revascularization (TLR), and TVR significantly [13,16]. Additionally, to improve the outcomes of revascularization, dual-antiplatelet therapy using aspirin and ticagrelor is indicated significantly increased graft patency after 1 year vs aspirin alone [17].

Conclusions

We successfully demonstrated SVG PCI using EPD for the treatment of SVG disease. Appropriate stent selection, EPD use, and selective pharmaceutical medication are all critical to minimizing unwanted complications. In the SVG intervention, DES was found to be superior over BMS for SVG intervention. In high-risk patients, PCI is superior to treat SVG disease over repeated CABG, and EPD should be used whenever technically possible to minimize the risk of distal embolus and improve SVG-PCI results.

Ethics approval

Not applicable.

Patient consent

Written informed consent was obtained from the patient for the anonymized information published in this article.

Availability of data and material

Data sharing does not apply to this article as no datasets were generated or analyzed during the current study.

Authors' contributions

AN, DN, and EPBM contributed to the concept and design of the article, acquisition of patient's data, and drafting of the article. AP and IP were involved in revising the article critically for important intellectual content.

Supplementary movie legends

Supplementary movie S1. Lesion at mid part of SVG graft to PDA was stented with Angiolite – Sirolimus drug eluting stent 4.0/29mm up to 12 atms. The FilterWire was placed at the distal of the lesion during stenting.

Supplementary movie S2. Lesion at proximal part of SVG graft to PDA was stented with ORSIRO 3.5/26 mm up to 18 atms. The FilterWire was placed at the distal of the lesion during stenting.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.radcr.2022.08.103.

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