A Challenging Case of Acute Myocardial Infarction after Bypass: Treat the Culprit Graft or the Native Vessel?

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Abstract

Percutaneous coronary intervention (PCI) for saphenous vein graft occlusion related acute myocardial infarction (AMI) has been associated with poor angiographic outcomes, poor procedural outcomes, and poor clinical outcomes. However, revascularization of the native vessel is challenging for cardiologists because of the high SYNTAX score and complex lesions in these coronary artery bypass graft (CABG) patients. Herein, we present a CABG case with vein graft occlusion complicated by ST segment elevation myocardial infarction (STEMI), treated successfully with primary PCI for both vein graft and native vessel.

Keywords: acute myocardial infarction, coronary artery bypass graft, native vessel, vein graft

Introduction

Coronary artery bypass graft (CABG) is one of the mainstream treatments for coronary artery disease (CAD). The conduits commonly used for bypass grafts are the left internal mammary artery (LIMA) and saphenous vein graft (SVG). After CABG, bypass graft failure is a frequent occurrence, especially many years after surgery.[1] Despite increased use of medication for secondary prevention, the progression of atherosclerosis in the bypass graft and the native coronary artery remains a problem for patients after receiving CABG. The failure rate of such grafts remains around 3% to 5% per year,[2-6] whereby the accelerated atherosclerosis characteristic of vein grafts means they have a higher failure rate than arterial grafts.[1] In addition, patients with previous CABG are at an increased risk of acute myocardial infarction (AMI).[7] To achieve revascularization, redoing CABG carries a higher risk than the initial CABG, and percutaneous coronary intervention (PCI) is considered a better procedure after CABG.[8] Despite the potential advantages of PCI, revascularization of an occluded vein graft is frequently complicated by high thrombotic burden, distal embolization and no-reflow phenomenon, with worse procedural and clinical outcomes.[9-11] However, revascularization of native vessels is also challenging because patients receiving CABG

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usually have high SYNTAX scores and complex lesions in the native vessels, making it difficult for cardiologists to decide which vessel to treat. We herein report a case with CABG, presenting with ST segment elevation myocardial infarction (STEMI) because of vein graft failure, who received revascularization for the vein graft and native vessel.

Case Report

A 61-year-old male presented at the emergency department with chest tightness and cold sweating lasting for two hours. His underlying medical history included type II diabetes mellitus, hyperlipidemia, smoking, CAD with triple vessel disease and an AMI episode following emergency CABG with two saphenous vein grafts in 2005. Physical examination revealed clear breathing sound and regular heart beats without murmur. Chest x-ray showed a clear lung field, and electrocardiography (ECG) revealed ST segment elevation over the inferior leads. Laboratory examination revealed N-terminal pro-brain natriuretic peptide level was 1888 pg/mL (normal range: <125 pg/mL), troponin-T was 1195 ng/L (normal range: ≤14 ng/L), creatine kinase was 410 U/L (normal range: 10-160 U/L) and creatine kinase-MB was 24 U/L (normal range: <16 U/L).

Under the diagnosis of inferior STEMI, emergency PCI was performed for this patient. Diagnostic coronary angiography revealed that the first saphenous vein graft (SVG) to the left anterior descending artery (LAD) and LAD-diagonal was patent, the second SVG to the left circumflex (LCX) obtuse marginal (OM) branch was patent, the second SVG from the LCX-OM to the posterior descending artery (PDA) was totally occluded, and the right coronary artery (RCA) showed severe atherosclerosis with middle RCA chronic total occlusion (CTO) (Figure 1). The RCA was engaged with a 1.0 x 6 Fr SAL guide catheter via the right femoral artery. Despite the support of an APT microcatheter (APT Medical, China), Fielder FC wire (Asahi Intecc Medical,

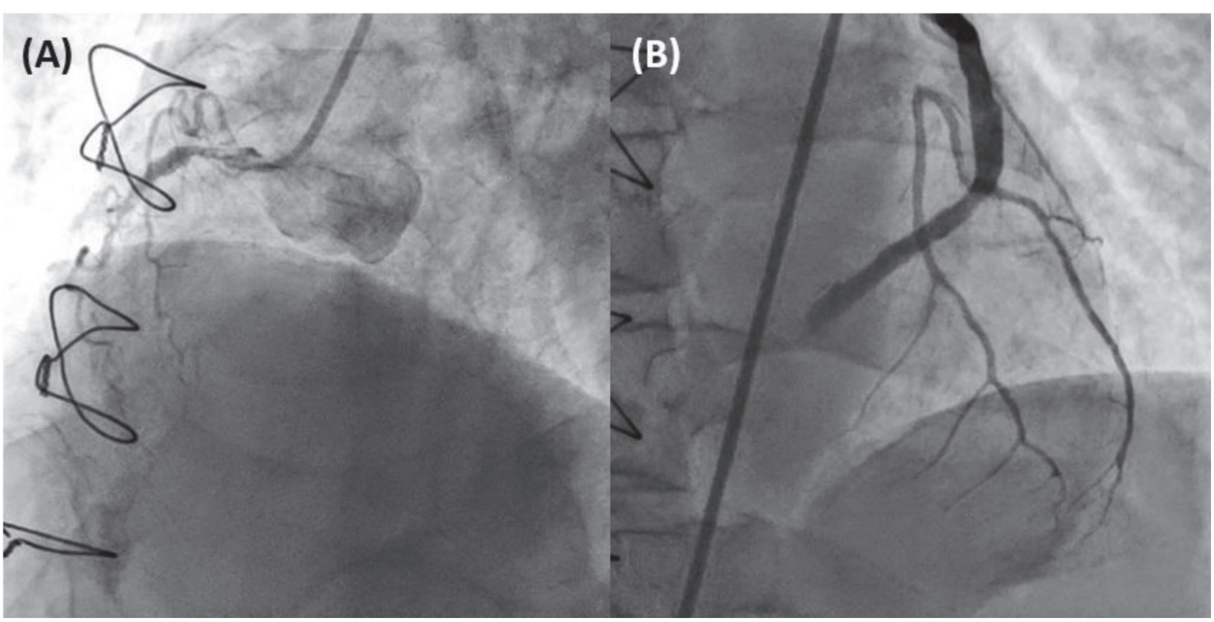

Figure 1. Diagnostic coronary angiography. (A) RCA severe atherosclerosis with middle RCA CTO. (B) SVG from LCX-OM to PDA total occlusion.
CTO = chronic total occlusion; SVG = saphenous vein graft; LCX = left circumflex; OM = obtuse marginal; PDA = posterior descending artery; RCA = right coronary artery.

Japan) and Fielder XTA wire (Asahi Intecc Medical, Japan) we could not cross the totally occluded site. We shifted our approach to the second SVG lesion, which we engaged with a 1.0 x 6 Fr SAL guide catheter. With the support of an APT microcatheter, a Fielder FC wire was successfully advanced to the distal RCA. We performed manual thrombus aspiration several times with an Eliminator (Terumo, Japan) at the second SVG. Subsequent angiography revealed a huge thrombus in the distal second SVG and critical stenosis at the junction of the second SVG and PDA. We attempted distal dilation with a 2.0 x 20 mm balloon catheter (BC), and administered intracoronary Aggrastat bolus dose infusion to the second SVG via the Eliminator catheter. The flow in the second SVG to the PDA reached TIMI II flow. However, severe recoil stenosis and the huge thrombus at the second SVG to PDA junction persisted (Figure 2A). Given the persistent residual thrombus and slow flow through the second SVG to the PDA, we considered it would close up soon. We therefore decided to perform RCA intervention to address the poor flow in the thrombotic second SVG.

Another 1.0 x 6 Fr SAL guide catheter was engaged to the RCA via the left femoral artery. A retrograde Gaia 2 (Asahi Intecc Medical, Japan) wire was advanced to the middle RCA. With distal wire guiding, the Gaia 3 (Asahi Intecc Medical, Japan) wire was advanced successfully to the distal RCA. With the support of a GuideLiner 5.5 Fr catheter, the middle RCA lesion was sequentially dilated by 1.0 x 6 mm BC and 1.2 x 6 mm BC. However, while retrieving the balloon catheter, the Gaia 3 wire was pulled out due to impingement of the wire and balloon catheter. We attempted an antegrade return approach but failed. We shifted to the retrograde approach with a Fielder FC wire, which we were able to advance into the antegrade guide catheter and the antegrade APT microcatheter. Using the rendezvous technique, we successfully advanced the antegrade APT microcatheter to the PDA over the retrograde wire (Figure 2B). The antegrade ATP microcatheter was replaced with Sion Blue wire. We sequentially dilated the proximal RCA to distal RCA with a 1.5 x 20 mm

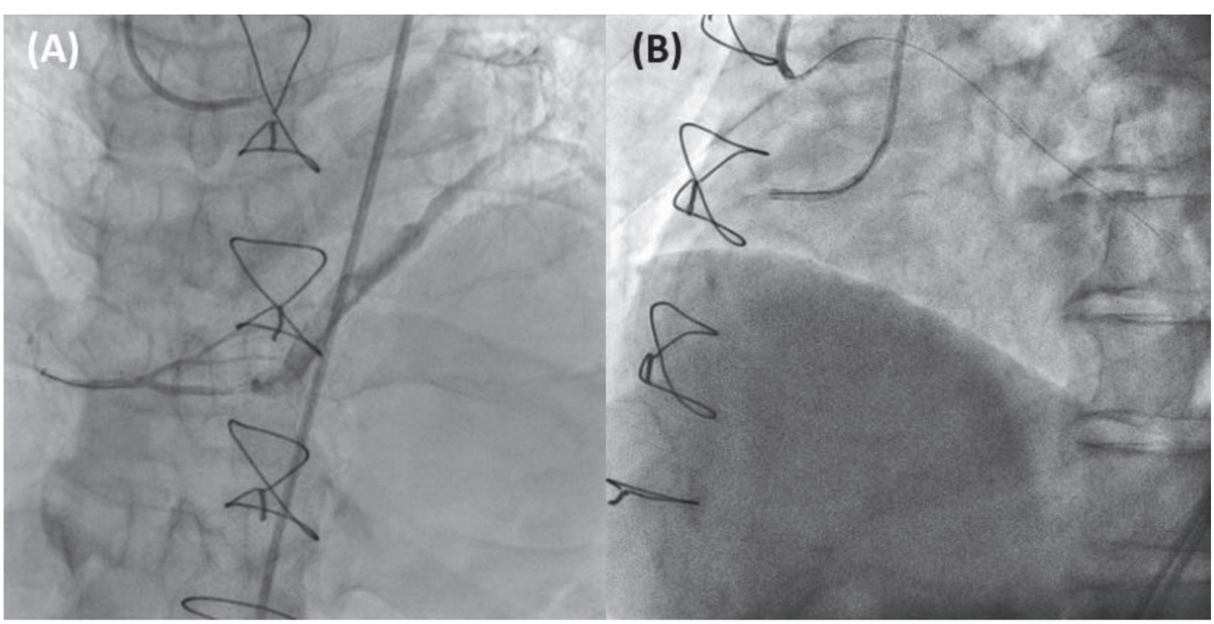

Figure 2. Figure 2. (A) Severe recoil stenosis and huge thrombus at the SVG to PDA junction. (B) Rendezvous technique; the antegrade APT microcatheter was advanced to the PDA over a retrograde wire. SVG = saphenous vein graft; PDA = posterior descending artery.

BC and 2.0 x 20 mm BC, and used intravascular ultrasound to check the vessel size and confirm that it was within the true lumen. The proximal to distal RCA was dilated with a 2.5 x 15 mm non-compliant (NC) balloon catheter. We deployed three overlapping drug-eluting stents (DES) at the ostium of the RCA to the distal RCA, followed by post-dilatation with a 2.5 x 8 mm NC BC in the distal RCA, a 2.75 x 8 mm NC BC in the middle RCA and a 3.0 x 8 mm NC BC in the proximal RCA. The final angiography showed TIMI III flow in the RCA, and even in the second SVG.

The total procedure time was 4 hours and 57 minutes, and the contrast medium volume was 170 mL. After the intervention, the patient was treated with Aggrastat and heparin pump for one day. He was discharged from the hospital after three days. During follow-up in the clinic, no significant symptoms were reported.

Discussion

Patients with previous CABG who present with acute occlusion of the bypass graft, especially a vein graft, present a hard therapeutic challenge for cardiologists. Compared to thrombolytic treatment, mechanical reperfusion of vein graft occlusion achieves higher patency rates.[12] However, mechanical reperfusion is usually complicated by high thrombotic burden, distal embolization, and no-reflow phenomenon,[9-11] causing early re-occlusion of the vein graft and poor short-term outcome, as seen in our case.

Previous CABG patients with AMI and revascularization have worse angiographic and 90-day clinical outcomes, including death, congestive heart failure and shock.[13] This is especially true when the culprit vessel is a bypass graft and most of the bypass graft is vein graft. Such patients with previous CABG are usually older and have more comorbidities. Some adjunctive therapies including thrombectomy, distal embolic protection and DES deployment may improve angiographic and short-term outcomes. With regard to long-term outcomes, graft survival following revascularization after AMI because of vein graft occlusion is poor. Both the culprit infarcted vein graft and non-infarcted vein graft present high rates of occlusion or TVR at one year and at 5 years. Over the long-term this worsens, and primary PCI for vein graft occlusion is a strong independent predictor.[14] However, LIMA grafts remain free from occlusion or TVR in more than 90% of patients at 5 years. Several parameters are associated with native vessel treatment, including STEMI, severe graft stenosis, longer time since the prior CABG, lower baseline TIMI flow, male sex and diabetes. However, in CABG patients with multivessel coronary artery disease, revascularization of the vein grafts is considered to be better.[15]

In conclusion, our case demonstrated that acute occlusion of vein grafts is commonly associated with extensive atherosclerotic and thrombotic burden, which increases the risk of distal embolization and no-reflow phenomenon and, hence, poor outcomes. Preferential intervention to the native coronary arterial circulation should be considered as an alternative route to achieve reperfusion of the myocardium and, where possible, can result in higher acute success and late patency rate. The main factors influencing PCI target vessel selection include: 1) the disease severity of the vein grafts (gradually worsens with longer period since prior CABG) and 2) the disease severity of the native coronary artery (long, tortuous and calcified lesions, or presence of CTO lesion). In addition, rendezvous technique is a useful method when using a bidirectional approach for CTO lesions.

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