Case Report

Successful recanalization of chronic total occlusion using retrograde approach in a patient with acute coronary syndrome due to aortosaphenous vein graft occlusion

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Summary

Although percutaneous coronary intervention (PCI) is one of the most suitable treatment options in patients with acute coronary syndrome (ACS), PCI for ACS patients with occluded saphenous vein graft (SVG) remains challenging. An 80-year-old man with previous coronary artery bypass grafting (CABG) was admitted with the diagnosis of ACS. Emergent coronary angiography showed a total occlusion of SVG to the left circumflex coronary artery (LCx) with large thrombus burden. Because of concern about serious distal embolization, we subsequently performed primary PCI for the occluded native LCx using a combined antegrade and retrograde approach with the SVG as an access conduit. Successful crossing of the native LCx was achieved by retrograde wire through the SVG, and finally recanalization and stent placement was done. A retrograde approach for chronic total occlusion of coronary artery has become more popular during recent years with encouraging results. This novel technique may provide an additional therapeutic option even in ACS patients with previous CABG.

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Introduction

Saphenous vein graft (SVG) occlusion is a major cause of acute coronary syndrome (ACS) in patients with coronary artery bypass grafting (CABG). Although the instruments and the techniques of percutaneous coronary intervention (PCI) have been developed, PCI for degenerated SVG remains challenging because mechanical manipulation of these soft,
Friable thrombus and atherosclerotic plaques is associated with a significant rate of procedural complications and mortality [1].

Recently, PCI techniques for recanalization of bypassed native coronary artery using a retrograde approach with the SVG as an access conduit have been reported [2]. A strategy of a combined antegrade and retrograde approach has been developed to facilitate the recanalization of chronic total occlusions (CTOs) with a high success rate and few complications, but is usually performed in patients with stable angina.

In this report, we describe successful recanalization of occluded native coronary artery using a retrograde approach in a patient with ACS and cardiogenic shock due to SVG occlusion.

**Case report**

An 80-year-old man, who had received CABG for three-vessel disease 10 years earlier, was admitted to our hospital with a diagnosis of non-ST elevation myocardial infarction (MI). Because the delay between the onset of symptoms and the arrival at hospital was over 12 h and his chest pain had already disappeared, we began to treat him conservatively with heparin, aspirin, and vasodilators. About 1 h after admission to the cardiac care unit, he again complained of chest pain and suddenly went into shock. An electrocardiogram revealed significant ST segment depression in lateral leads. An intra-aortic balloon pump was placed, and emergent coronary angiography revealed the following: 75% stenosis in the mid-left anterior descending coronary artery (LAD), a CTO in the proximal right coronary artery (RCA), a CTO in the distal left circumflex coronary artery (LCx) (Fig. 1A), a patent left internal thoracic artery graft to the 1st diagonal branch, a patent SVG to the RCA, and an occluded SVG to the LCx with thrombus (Fig. 1B).

PCI attempt was first performed for the occluded SVG that was considered to be the culprit lesion. Access was obtained from the left femoral artery and 7Fr AL1 guiding catheter (Mach1, Boston Scientific, San Diego, CA, USA) was engaged to the ostial vein graft. However, contrast injection through a microcatheter (Finecross, Terumo, Tokyo, Japan), which was advanced to the SVG over the hydrophilic-coated floppy wire (Runthrough, Terumo), showed diffuse thrombi extending from the ostial graft to the distal anastomosis (Fig. 2). Due to the large thrombus burden and long occluded segment in the SVG, we decided to treat the occluded native LCx for acute MI.

To improve the success rate of PCI, we attempted a combined antegrade and retrograde approach. A 6Fr EBU3.5 guiding catheter (Launcher, Medtronic, Santa Rosa, CA, USA) from right femoral artery was engaged to the left coronary ostium and a stiff wire (Miracle3, Asahi Intecc, Nagoya, Japan) was advanced antegrade to the proximal cap of the CTO. The Runthrough wire was advanced retrogradely to the distal of LCx through the SVG and was exchanged to another Miracle3 wire via the microcatheter. Then, the CTO lesion...
was simultaneously approached in the antegrade and retrograde fashion (Fig. 3A). Both antegrade and retrograde Miracle3 wire entered into the respective subintimal spaces with overlap at the CTO. In order to create a proximal dissection space, a 2.0 \( \times \) 10 mm balloon (bp22, Kaneka, Osaka, Japan) was advanced over the antegrade wire and was inflated in the subintimal space of CTO. Following subintimal dilatation, the retrograde wire successfully penetrated the distal cap of the CTO and reached the proximal true lumen and entered into the aorta. We subsequently snared the tip of the retrograde wire, which was extended with an extension wire (Extension, Asahi Intec), using a snare device (Mini En Snare system, Angiotech, Gainesville, FL, USA) through the EBU3.5 guiding catheter. The wire was slowly withdrawn and exteriorized out of the antegrade guiding catheter (Fig. 3B). We advanced the microcatheter antegradely to the LCx from the tip of the retrograde wire. Then, the retrograde wire was removed and the Runthrough wire was antegradely advanced to the LCx through the microcatheter. Finally, after balloon pre-dilatation, two long drug-eluting stents (Taxus Liberte 3.0 mm \( \times \) 32 mm and 3.0 mm \( \times \) 28 mm, Boston Scientific) were deployed over the antegrade Runthrough wire with TIMI 3 flow in the native LCx (Fig. 3C and D). The time from the introduction of the guiding catheter to the initial reperfusion of the native LCx and to the end of the PCI procedure was 96 and 128 min, respectively. The total amount of contrast media for the diagnostic angiography and PCI procedure was 265 ml.

Although the maximum creatine kinase reached 4058 IU/l, the patient fully recovered from acute phase of MI without any major complications, and received cardiac rehabilitation thereafter.

**Discussion**

SVGs are frequently used for CABG. However, these thin-walled SVGs begin to fail with intimal hyperplasia, thrombosis, and progressive atherosclerosis, when exposed to high wall stress by systemic arterial pressure [1]. Each year, 3% of patients with previous CABG develop an acute MI, of which about 30—50% are due to an acute occlusion of SVG [3]. In patients with acute MI due to SVG occlusion, mortality within 1 year is 20% [4]. The present case highlights the aforementioned challenges.

Our patient presented with ACS involving a LCx SVG with a large volume of occlusive thrombus. PCI is one of the most suitable treatment options in ACS [5]. However, mechanical manipulation of soft, friable thrombus and atherosclerotic plaques in SVG is frequently associated with serious proce-
dural complications, such as distal embolization and slow- or no-reflow phenomenon [1]. To overcome these problems, there are distal protection devices available for eligible patients. Previous studies indicated that application of distal protection devices during PCI of stenotic SVG could significantly reduce peri-procedural myocardial infarction by preventing distal embolization [6]. However, these studies were performed with non-acute SVG diseases, and there is no evidence supporting the use of distal protection devices in ACS patients with large thrombus burden. Additionally, there is good evidence that successful PCI to the native coronary arteries has better long-term patency rates than vein graft intervention [7]. Therefore, in this case we made the decision to treat occluded native vessel with PCI.

Successful revascularization of CTO is one of the most difficult challenges in the field of PCI. Despite advances in the instruments and the techniques, procedural success rates with antegrade approach are about 60—80% [8]. To improve this suboptimal success rate of PCI, we attempted a combined antegrade and retrograde approach. A new strategy of this approach for CTO has become more popular during recent years with encouraging results. With this combined approach, CTO can be simultaneously approached by using accessory channels, such as septal and epicardial collaterals or bypass grafts as access conduits [2]. The proposed mechanism for the advantage of retrograde approach is that the distal fibrous cap may be less calcified and more amenable to the penetration by a guidewire than the proximal cap [9]. Indeed, successful crossing of the entire occluded native coronary artery was achieved by retrograde wire through the SVG without any difficulties in the present case.

To facilitate retrograde wire crossing, we also attempted a reverse controlled antegrade and retrograde subintimal tracking (CART) technique. Among the different techniques in antegrade and retrograde approach for CTO, the reverse CART technique creates a connection between the subintimal space of the CTO and the proximal true lumen by antegrade subintimal ballooning [10]. Although several unexpected complications associated with the retrograde approach have been reported [10], the reverse CART technique may minimize the potential risk of distal embolization or vascular injury with manipulation of the infarct-related SVG, since this technique requires minimal delivery of devices via the retrograde conduit.

When an ACS involves a SVG, we need to decide whether to treat the culprit bypass graft or the underlying native coronary artery. In the present case, we achieved successful recanalization of occluded native vessel using the retrograde approach without procedural complications that could be associated with manipulation of degenerated vein graft. This novel approach, which improves the success rate of PCI for CTO, may provide an additional therapeutic option even in ACS patients with previous CABG.

References