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Case Report

Stent collapse caused by balloon occlusion and aspiration system in saphenous vein graft intervention

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ABSTRACT

We present the case of an 82-year-old male patient with unstable angina pectoris referred for percutaneous coronary intervention in the saphenous vein graft (SVG) to left circumflex coronary artery. An everolimus-eluting cobalt chrome stent was successfully deployed, using an embolic protection device with balloon occlusion and aspiration system. During the procedure of aspiration thrombectomy, the deployed stent unexpectedly collapsed. We re-dilated the collapsed stent using the same distal protection and aspiration system. However, the stent collapsed again during the aspiration procedure. As we could successfully re-dilate the collapsed stent using the same balloon occlusion and aspiration system after pulling the guide catheter out from the ostium of SVG, we concluded that the collapse of the stent was caused by the excess negative pressure generated by the distal occlusion and aspiration procedure under the completely wedged guide catheter into the ostium of SVG. We believe this is the first report of stent collapse due to excess negative pressure during aspiration thrombectomy.

<Learning objective: Since the radial strength of coronary stents is high enough, deployed stent collapse is a rare complication. This case report describes a novel mechanism of stent collapse, which was caused by the excess negative pressure generated by the distal occlusion and aspiration procedure in saphenous vein graft intervention. To avoid this type of complication, in using distal protection devices, the side-hole guide catheter should be used, or the guide catheter should be carefully manipulated not to be wedged.>

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Introduction

Coronary stent is an intravascular scaffolding, composed of thin mesh-shaped metal struts which support the vessel wall from the inside. Coronary stents have sufficient radial strength, which means the amount of force to keep the lumen open, against the outer load from the vessel wall [1]. Since coronary stent platforms are constantly evolving, newer stents are made of thin metal alloys such as cobalt–chrome (CoCr) or platinum–chrome, in keeping with adequate radial strength [2]. If the radial strength of stent structure is not sufficient, narrowing of the stent–vessel complex caused by inward radial pressure from the vessel wall may occur, which potentially influences the acute and long-term outcomes after the stenting. In recent years, there has been an increasing number of reports showing longitudinal stent shortening (LSS) [3], although it

seems to be an infrequent complication (0.7–1.0% of deployed stents) [4]. LSS can be caused by interaction with the stent and guide catheter, balloon, another stent or ultrasound catheter [4]. On the other hand, few authors have reported stent collapse (deformity in radial direction and narrowing in area inside stent) occurring immediately after stenting [5,6]. Immediate stent collapse can be caused by vascular spasm [5] and elastic recoil of the vessel [6]. We herein report a rare complicated case, that we believe is the first report, with remarkable CoCr everolimus-eluting stent (EES) collapse caused by the excess negative pressure generated by the distal occlusion and aspiration procedure under the completely wedged guide catheter into the ostium of the target vessel.

Case report

An 82-year-old male patient was admitted because of unstable angina. He had histories of hypertension, dyslipidemia, and coronary artery bypass grafting (CABG) [left internal mammary (LIM) to left anterior descending artery (LAD), saphenous vein graft

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(SVG) to left circumflex artery (LCx), and SVG to right coronary artery (RCA)] twenty years previously. Coronary angiography revealed proximal occlusions of all native coronary arteries bypassed and a severe narrowing in the proximal segment of the SVG to the posterolateral branch (PL) of the LCx (Fig. 1A). A LIM graft to the LAD was patent and an SVG to the RCA had been chronically occluded. The patient was referred for percutaneous coronary intervention (PCI) for the SVG to the PL. A 6-French size Heartrail-II AL1.5 guide catheter (Terumo Corp., Tokyo, Japan) was inserted from the femoral artery and engaged to the SVG ostium and a 0.014-inch Runthrough-NS floppy guidewire (Terumo Corp.) was placed across the target stenosis. Intrafocus-WR intravascular ultrasound (IVUS; Terumo Corp.) images demonstrated a significant stenosis with an abundance of attenuated plaque (Fig. 1B through D), suggesting a high risk of subsequent distal embolism. Therefore, we decided to use a distal protection (DP) device GuardWire (Medtronic Inc., Minneapolis, MN, USA) to capture the atheroemboli that might be possibly liberated from the target lesion. After pre-dilation of the lesion with semi-compliant balloon (Tazuna 2.5 mm × 15 mm, Terumo Corp.), the GuardWire was passed into the distal SVG and inflated to block the antegrade flow. Then a CoCr-EES (Xience Prime 3.5 mm × 28 mm, Abbott Vascular, Santa Clara, CA, USA) was successfully deployed in the distal part of the SVG lesion using an inflation pressure of 12 atmospheres, following an aspiration using Thrombuster-II catheter (Kaneka Corp., Osaka, Japan). During the aspiration procedure, the deployed stent unexpectedly collapsed (Fig. 2A, B, E and F). We speculated that the severe elastic recoil of the vessel wall collapsed the stent. Therefore, the stent was re-dilated using the stent-delivery balloon and same DP system. However, the stent collapsed again during the aspiration procedure. IVUS images after the second procedure demonstrated a significant collapse in the distal part of the stent, with significant gaps between stent struts and vessel wall (Fig. 2H). IVUS also demonstrated well-expanded and -apposed struts in the proximal part of the stent (Fig. 2G). After the second attempt of the aspiration, we became aware that while pulling back the aspiration catheter, the tip of the guide catheter was pulled into the SVG ostium and then guide catheter pressure wave damping was observed. It suggested wedging of the guide catheter and generation of a “dead-end” of the vessel. We concluded that the

collapse of the stent was caused by the excess negative pressure generated by the DP procedure under the completely wedged guide catheter into the SVG ostium (Fig. 2C and D). Finally, we pulled out the tip of the guide catheter from the SVG ostium and then successfully re-dilated the deployed stent without significant collapse during the aspiration procedure. Subsequently, another CoCr-EES (Xience Prime 3.5 mm × 33 mm) was successfully deployed in the proximal part of the SVG lesion, following an aspiration procedure. Postdilation was successfully completed using a non-compliant balloon (Hiryu 4.5 mm × 15 mm, Terumo Corp.) and the same DP system without stent collapse. Post-procedural angiography and IVUS demonstrated a good result (Fig. 3A through D). The patient was discharged with no chest symptoms and, to date, free from cardiovascular events.

Discussion

Immediate collapse of implanted coronary stent is a rare complication, and, to our knowledge, few authors have reported it previously. Current stents on the market are thought to have sufficient radial strength against the external coronary artery strain [2]. The Multi-Link stent, the platform of CoCr-EES, is one of the stents with strong radial strength [7]. Our case demonstrated the novel mechanism of immediate stent collapse, and, to our knowledge, it is the first reported case of stent collapse caused by an excess negative pressure generated by DP procedure during PCI.

The complications in our case are summarized that: (1) during the distal balloon occlusion and aspiration procedure, the deployed stent unexpectedly collapsed; (2) the collapsed stent was re-dilated using the same DP system; (3) however, the stent collapsed again during the aspiration procedure; (4) then, we were aware that during the aspiration procedure, the guide catheter was pulled into the ostium of SVG accidentally; (5) finally, we pulled out the guide catheter not to be wedged and then the stent could be re-dilated without any collapse.

We believe that the main cause of this complication was the unusual excess negative pressure generated during aspiration procedure under the completely wedged guide catheter into the ostium of SVG. No previous publications have cited the collapse of the stent as observed in our case. After pulling the guide catheter

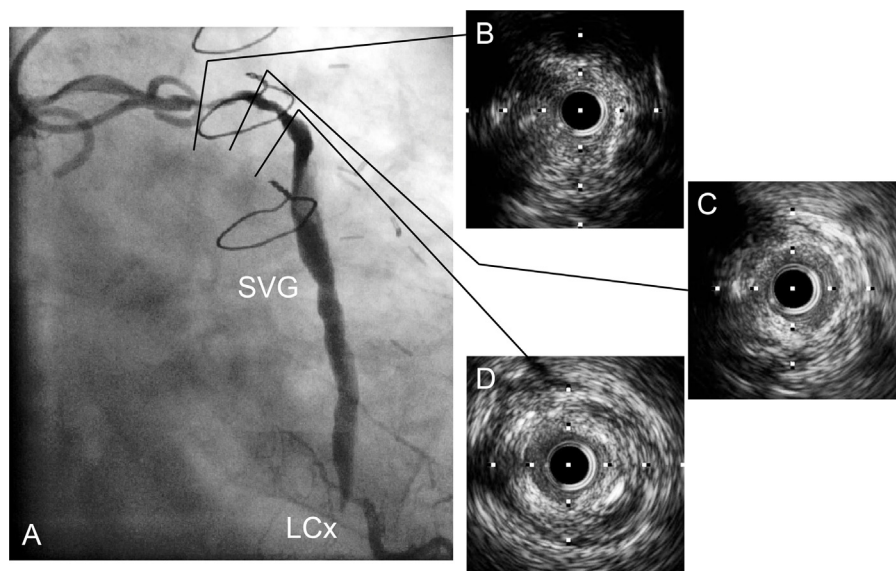


Fig. 1. Baseline angiography and IVUS findings before percutaneous coronary intervention. (A) Severe narrowing of the proximal SVG; (B through D) IVUS showed an abundance of attenuated plaque in the lesion of the SVG. (B) Ostial lesion; (C) mid of the lesion; (D) distal site of the lesion. IVUS, intravascular ultrasound; LCx, left circumflex artery; SVG, saphenous vein graft.

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