Case Report

http://dx.doi.org/10.4070/kcj.2016.46.6.862
Print ISSN 1738-5520 • On-line ISSN 1738-5555

Korean Circulation Journal

Extraction of a Fully Deployed Coronary Stent during Retrieval of Another Dislodged Stent

Jongmin Hwang, MD, Kook-Jin Chun, MD, Dae Sung Lee, MD, Soo Yong Lee, MD, Min Ku Chon, MD, Sang Hyun Lee, MD, Ki Won Hwang, MD, and June Hong Kim, MD

Cardiovascular Center, Pusan National University Yangsan Hospital, Division of Cardiology, Department of Internal Medicine, Pusan National University School of Medicine, Yangsan, Korea

Coronary stent dislodgement is a rare and serious complication of percutaneous coronary intervention and is associated with major adverse cardiac events. Successful retrieval of the stent is recommended in this situation because it is important for the prognosis. Recently, a patient was referred to our hospital with a dislodged coronary stent. When attempting to percutaneously extract the dislodged stent, a challenging situation was encountered, as the stent was entrapped and tightly entangled with another fully deployed coronary stent. Extraction of a fully deployed stent is generally prohibited as it may result in severe complications. Nevertheless, we extracted both the dislodged stent and the fully deployed stent, as a last resort. Herein, we report about this case. Our case highlights if the operator had a thorough understanding of the surrounding circumstances regarding the fully deployed coronary stent, successful extraction of the fully deployed coronary stent without any complications could be possible. **(Korean Circ J 2016;46(6):862-865)**

KEY WORDS: Percutaneous coronary intervention; Stent; Complication.

Introduction

Although its incidence is decreasing, coronary stent dislodgement continues to occur in this modern era of percutaneous coronary interventions (PCI). It is often associated with significant morbidity, including systemic or coronary embolizations, acute myocardial infarctions (MI), emergency coronary artery bypass graft surgeries (CABG), and even death.[1] Several factors are associated with stent dislodgement, including heavy vessel calcification, pronounced vessel tortuosity, diffuse disease, and an attempt to deliver a stent to a distal lesion through a previously implanted proximal stent.[2] Unfortunately, coronary stents cannot be extracted or repositioned after deployment. Extraction of a fully deployed stent may cause endothelial injury, dissection, or perforation of coronary arteries. While many reports have previously described retrieval of a dislodged stent, reports on cases of fully deployed stent are rare.

We report a case of extraction of a fully deployed coronary stent during retrieval of another dislodged stent.

Received: December 15, 2015
Revision Received: April 11, 2016
Accepted: May 3, 2016
Correspondence: Kook-Jin Chun, MD, Cardiovascular Center, Pusan National University Yangsan Hospital, Division of Cardiology, Department of Internal Medicine, Pusan National University School of Medicine, 20 Geumo-ro, Mulgeum-eup, Yangsan 50612, Korea
Tel: 82-55-360-1454, Fax: 82-55-360-2204
E-mail: ptca82@gmail.com

• The authors have no financial conflicts of interest.

Case

A 65-year-old male patient visited a local hospital complaining of chest pain, but did not present with any cardiovascular risk factors. Coronary angiography (CAG) at a local hospital revealed severe three vessel disease. The patient was found to have 90% stenosis in the proximal segment of the left anterior descending artery (LAD), 90% stenosis at the proximal segment, total occlusion at the distal segment in the left circumflex artery (LCX), and the right coronary artery (RCA) showed diffuse, tortuous, and up to 90% stenosis at the proximal to mid segment with near total occlusion at the distal segment (Fig. 1A). A 2.75×26 mm drug eluting stent (DES)

was implanted in the proximal LAD and two DESs of 2.75×38 mm, and 2.75×22 mm (Xience Xpedition, Abbott Vascular, Santa Clara, CA, USA) were implanted in the proximal and mid segments of the RCA, respectively (Fig. 1B).

On the next day, staged PCI for distal RCA was attempted via the right femoral artery. After pre-dilation with a 2.5×20 mm balloon at the distal RCA, the operator made several attempts to deliver a 2.5×38 mm DES (Promus Premier, Boston Scientific, MN, USA) through a previous stent with no success. While pulling the undeployed stent back into the guiding catheter, it became entrapped by the fully deployed proximal RCA DES (Xience Xpedition, Abbott Vascular, Santa Clara, CA, USA). After several retrieval attempts, the undeployed stent was totally detached from the stent balloon. Fluorography revealed that part of the dislodged stent was almost located out of the RCA ostium, and flail motion of the stent, which was still entangled with a previous stent at the proximal RCA, was noted in the ascending aorta (Fig. 2A). During the procedure, the patient complained of chest pain and his electrocardiogram revealed ST segment elevation in leads II, III, and aVF. The patient was subsequently transferred to our hospital.

Through an 8 Fr guiding catheter (JR 4.0, Cordis, Bridgewater, NJ, USA), a snare catheter (6 Fr, 15 mm, Multi-Snare®, PFM Medical, Carlsbad, CA, USA) was positioned to capture the stent. After several attempts in the ascending aorta, we were able to seize the middle part of the undeployed stent and pushed and pulled the captured snare system several times with the aim of detaching it from the deployed DES (Fig. 2B). However, we failed to detach it from the deployed DES. On the contrary, the deployed DES at the proximal RCA had gradually elongated into the aorta (Fig. 2C). Thus, we decided to extract the two stents (dislodged and fully deployed elongated stent) as a last resort. After tugging with adequate manual force, the captured dislodged stent was bent in half and, successfully retrieved into the guiding catheter (Fig. 2D). Subsequently, both the undeployed and elongated deployed stents were successfully withdrawn into the guiding catheter under maximal manual retraction (Fig. 2E). After removal of the guiding catheter including the snare catheter and two stents, a follow-up CAG revealed dissection at the proximal RCA, without any

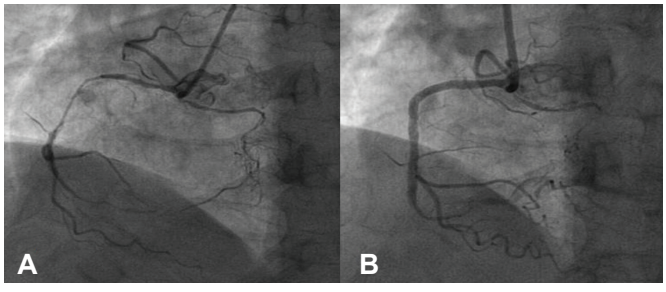

Fig. 1. Baseline coronary angiogram. (A) Left anterior oblique cranial view shows a diffused long lesion with a very small right coronary artery (RCA). (B) Two stents were inserted at the proximal and mid segments of the RCA.

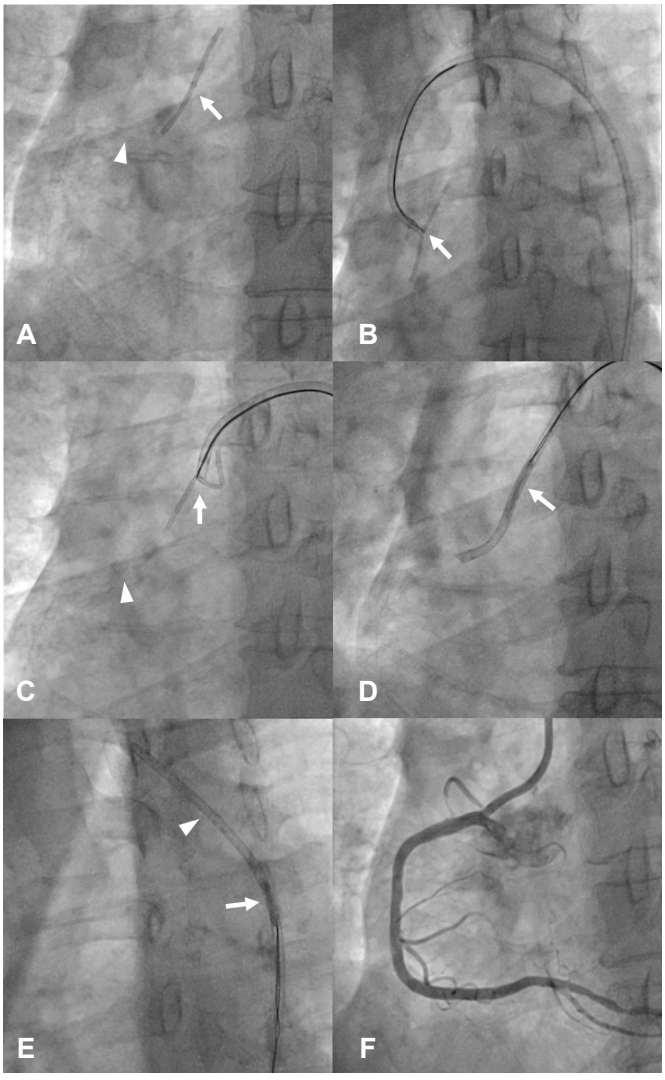

Fig. 2. Fluoroscopic images of the procedure. (A) The operator at the local hospital failed to deliver a second stent into the distal RCA. While attempting to retract the undeployed stent (white arrow) into the guiding catheter, the stent was entrapped by the fully deployed stent in the proximal RCA (white arrow head) and totally detached from the stent balloon. (B) We were able to capture the middle portion of the undeployed dislodged stent (white arrow) using a multi-snare catheter. (C) Under manual retraction, the proximal RCA deployed stent (white arrow head) was elongated but not detached from the undeployed dislodged stent (white arrow). (D) Under continuous retraction, the captured undeployed stent (white arrow) was bent in half and successfully retrieved into the guiding catheter. (G) Finally, both the maximally elongated proximal RCA stent (white arrow head) and the bent, partially dislodged stent (white arrow) were successfully retrieved into the guiding catheter. (H) Final CAG of the RCA showed excellent results with TIMI grade 3 distal flow. RCA: right coronary artery, CAG: coronary angiogram, TIMI: thrombolysis in myocardial infarction.

http://dx.doi.org/10.4070/kcj.2016.46.6.862

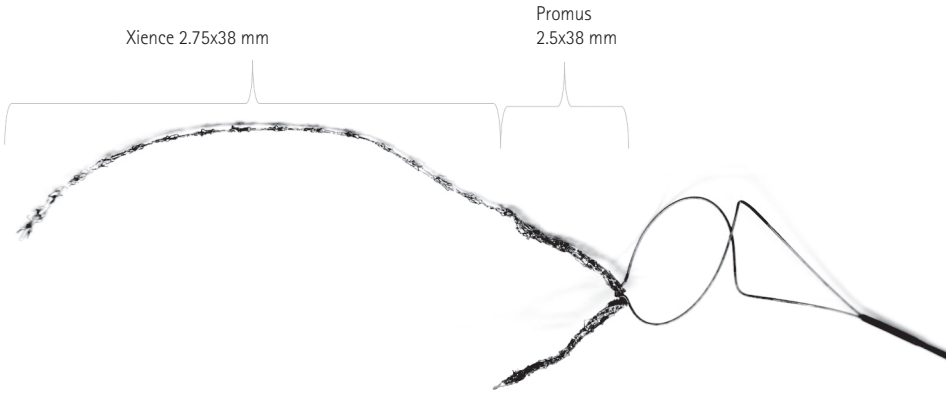

Fig. 3. Retrieved stents. The Xience 2.75x38 mm stent was once fully deployed and elongated into the proximal RCA. The Promus 2.5x38 mm stent was undeployed and bent in half upon retrieval using a multi-snare catheter. RCA: right coronary artery.

Fig. 4. Results of the in vitro maximal stretching test of two different types of stents. (A) is the stent with 3 connectors (Xience Xpedition, Abbott Vascular, Santa Clara, CA, USA) that was not fractured but rather elongated. (B) is the stent with 2 connectors (Promus Premier, Boston Scientific, MN, USA) that was fractured into four segments.

remnant part of the two stents. Two DES (3.5×34 mm at proximal RCA, 3.0×38 mm at d-RCA, Resolute Integrity, Medtronic, Santa Rosa, CA, USA) were successfully implanted under intravascular ultrasonography (IVUS, OptiCross, Boston Scientific, Natick, MA, USA) guidance. The final CAG showed acceptable results (Fig. 2F) and the patient was free of angina and subsequently discharged two days after the procedure.

Discussion

Coronary stent dislodgement is a catastrophic complication of PCI and is associated with arterial thrombosis, embolism due to retained stent fragments, and major adverse cardiovascular events (including myocardial infarction, stroke, and death).[3] Successful retrieval is important as it is associated with a good prognosis.[1] There are two retrieval methods available, either surgical or percutaneous. Percutaneous retrieval can be a good therapeutic option when the clinical situation and the patient's vital signs are stable. Several percutaneous retrieval techniques using a snare,[4] wire,[5] and balloon[6] have previously been established and a number of unique cases have been reported.[7][8]

In our case, the part of dislodged stent almost protruding into the ascending aorta and the distal remnant part was tightly entangled with the fully deployed stent in the proximal RCA. As we know, this is a situation that is rarely encountered and as such, common retrieval methods have several limitations. Our solution in this case was to first capture the middle portion of the undeployed dislodged stent using a multi-snare catheter in order to maximize the force of retraction, a unique point in our case. The dislodged stent was bent in half and safely and fully retrieved into the guiding catheter. Next, under normal manual retraction force, the proximal RCA deployed stent was gradually elongated. It was, however, not separated from the undeployed dislodged stent as the two were tightly entangled with each other. As we had no other option, we were forced to pull back on the two stents, finally extracting the fully deployed stent together with the dislodged stent without any major complications.

The successful extraction of a fully deployed stent in this case can be attributed to several factors. First, we performed IVUS of the RCA after both stents were removed and this showed that the vessel diameter of the proximal RCA was considerably larger (3.7 mm) than the previously deployed proximal RCA stent diameter (2.75 mm). IVUS also showed large amounts of remnant plaque burden, which suggests severe insufficient plaque modification. Moreover, the fully deployed proximal RCA stent had protruded marginally into the aorta. These findings suggest underexpansion and incomplete apposition of the stent, and paradoxically, would have facilitated stent extraction. Second, we attempted to remove

the stent just one day after the first procedure had been performed. This time interval was not sufficient for endothelialization of the stents. Third, stent character may have been a factor. Under maximal manual retraction, the proximal RCA fully deployed stent was not disconnected but rather elongated. To elucidate the mechanism of this phenomenon, we stretched several different types of stents maximally in an in vitro setting. Our results showed that a stent with 3 connectors (Xience Xpedition, Abbott Vascular, Santa Clara, CA, USA) was not disconnected, while a stent with 2 connectors (Promus Premier, Boston Scientific, MN, USA) was fractured into four segments (Fig. 4). In our case, the deployed stent was fortunately made up of 3 connectors. We believe that the number of stent connectors is therefore critical when attempting this procedure. If the deployed stents were comprised of 2 connectors (for example, a Promus stent), we would have alternatively considered surgical removal.

A small-sized stent when compared to the reference diameter under insufficient plaque modification, and protrusion of the stent into the aorta are the main reasons for successful retrieval in this case. However, they are also the cause of complication. We have frequently encountered difficulties when attempting to deliver a stent to a distal lesion through a previously implanted proximal stent. To avoid a stent trapping while passing through a previous stent, sufficient plaque modification should be performed at the site of the lesion prior to implantation to ensure that the stent is appropriate for the luminal area. Implantation of the distal stent first, and the proximal stent last, is a more reasonable and recommended method.

In conclusion, extra care should be given to avoid stent dislodgement when the lesion itself has many risk factors. Should an event occur such as that described in our case, extraction of a fully deployed stent may be carefully executed, provided there is a thorough understanding of the surrounding circumstances.

References

1. Bolte J, Neumann U, Pfafferott C, et al. Incidence, management, and outcome of stent loss during intracoronary stenting. *Am J Cardiol* 2001;88:565-7.
2. Brilakis ES, Best PJ, Elesber AA, et al. Incidence, retrieval methods, and outcomes of stent loss during percutaneous coronary intervention: a large single-center experience. *Catheter Cardiovasc Interv* 2005;66:333-40.
3. Alomar ME, Michael TT, Patel VG, et al. Stent loss and retrieval during percutaneous coronary interventions: a systematic review and meta-analysis. *J Invasive Cardiol* 2013;25:637-41.
4. Jang JH, Woo SI, Yang DH, Park SD, Kim DH, Shin SH. Successful coronary stent retrieval from the ascending aorta using a gooseneck snare kit. *Korean J Intern Med* 2013;28:481-5.
5. Collins N, Horlick E, Dzavik V. Triple wire technique for removal of fractured angioplasty guidewire. *J Invasive Cardiol* 2007;19:E230-4.
6. Kim JY, Yoon J, Jung HS, et al. Broken guidewire fragment in the radio-brachial artery during transradial sheath placement: percutaneous retrieval via femoral approach. *Yonsei Med J* 2005;46:166-8.
7. Kang JH, Rha SW, Lee DI, et al. Successful retrieval of a fractured and entrapped 0.035-inch terumo wire in the femoral artery using biopsy forceps. *Korean Circ J* 2012;42:201-4.
8. Kim JH, Jang WJ, Ahn KJ, et al. Successful retrieval of intravascular stent remnants with a combination of rotational atherectomy and a gooseneck snare. *Korean Circ J* 2012;42:492-6.

http://dx.doi.org/10.4070/kcj.2016.46.6.862