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CASE REPORT

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Lost and found: Coronary stent retrieval and review of literature

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Abstract

A 61-year-old man with a history of percutaneous coronary intervention (PCI) of the mid right coronary artery (RCA) with a drug eluting stent (DES), presented with non-ST segment elevation myocardial infarction. Coronary angiography demonstrated complex disease of the distal RCA as well as in-stent stenosis of the previously placed mid RCA stent. The patient underwent bifurcation PCI of the distal RCA followed by attempted intervention with a DES on the mid RCA lesion. The stent could not cross the lesion and eventually became dissociated from its delivery system. The lost stent was successfully retrieved using two different snaring systems. The procedure was terminated without further attempts for stent delivery. The patient had an uneventful recovery and underwent successful PCI of the mid RCA lesion one month later.

KEYWORDS

ACS/NSTEMI, complex percutaneous coronary intervention, coronary artery disease, foreign body retrieval, PCI complications, retrieval techniques, snaring systems, stent loss

1 | INTRODUCTION

Stent loss is an infrequent, yet potentially catastrophic complication of percutaneous coronary intervention (PCI). It is often caused by stent deformation during delivery attempts in tortuous and calcified coronary vessels, followed by stripping from the delivery balloon while the stent is being withdrawn. Lost stents can either be retrieved, especially when located in high risk coronary segments, such as the left main coronary artery, or deployed/crushed without attempting to retrieve them. We present a case that illustrates some of the challenges and treatment options associated with stent loss in the coronary arteries.

2 | CASE PRESENTATION

A 61-year-old man presented to the hospital with chest pain and dyspnea that started six hours prior to presentation, while watching television. Sublingual nitroglycerin administered in the emergency department decreased, but did not eliminate, his symptoms. The patient had undergone PCI of the mid right coronary artery (RCA) with a drug-eluting stent (DES) two years prior to presentation. The patient also had a long-standing history of hypertension, type II diabetes mellitus, and a 60-pack-year history of smoking. His vital signs were within normal limits and his physical examination was unremarkable except for mild diaphoresis. A 12-lead electrocardiogram in the emergency department revealed sinus rhythm, with normal intervals, no ST segment changes, and non-specific T-wave abnormalities in the inferior leads. All laboratory values were within normal limits except for elevated troponin I at 0.78 ng/mL (normal range $<$0.08 ng/mL) that subsequently increased to a peak of 1.25 ng/mL.

Given the ongoing chest pain, emergency coronary angiography was performed using right radial access, showing a right dominant coronary system without significant stenosis of the left main coronary artery, the left anterior descending artery (LAD), or the left circumflex artery (LCx). The RCA (Figure 1) appeared diffusely diseased with significant, 80% mid RCA in-stent restenosis. Intravascular ultrasound showed a minimum lumen area of 3 mm^2. At the RCA bifurcation, there was severe calcified 80% stenosis extending from the distal RCA to the proximal posterior left ventricular branch (PLV) and the posterior descending artery (PDA; 1.1.1 lesion according to the Medina classification). Furthermore, angiographic evidence of plaque rupture with a small associated thrombus in the PLV was appreciated and felt to be the culprit lesion.

Complex percutaneous coronary intervention at the RCA bifurcation was pursued. The RCA was engaged using an Amplatz Right 2, 6-Fr coronary guide catheter. Using the culotte technique, the PLV and PDA were wired and distal RCA bifurcation PCI was done with a 2.5 $\times$

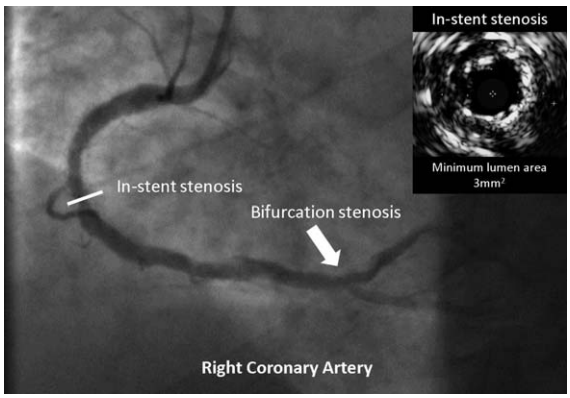

FIGURE 1 Right coronary artery angiogram and intravascular ultrasound prior to intervention

20 mm and a 3.0 × 24 mm Synergy DES (Boston Scientific, Marlborough, MA) followed by kissing balloon inflation and proximal optimization technique. Intervention on the mid-RCA stenosis was then attempted. The lesion was predilated with a 3.5 × 15 mm noncompliant balloon. Despite being supported by a GuideLiner catheter (Vascular Solutions, Minneapolis, MN), a 4.0 × 30 mm Synergy DES was unsuccessful in crossing the lesion due to heavy calcification. While retrieving the stent along with the GuideLiner, dissociation of the stent from its balloon/delivery system was noticed, with one-third of the stent in the RCA and the remainder in the guide catheter (Figure 2). An attempt to advance a low-profile balloon through the undeployed stent failed and pushed the stent out of the guide catheter floating into the aorta, while partially anchored by the guidewire.

The right femoral artery was immediately accessed through which the stent was successfully extracted using a Judkins Right 4 7 French guide catheter and two snaring systems—the Amplatz GooseNeck

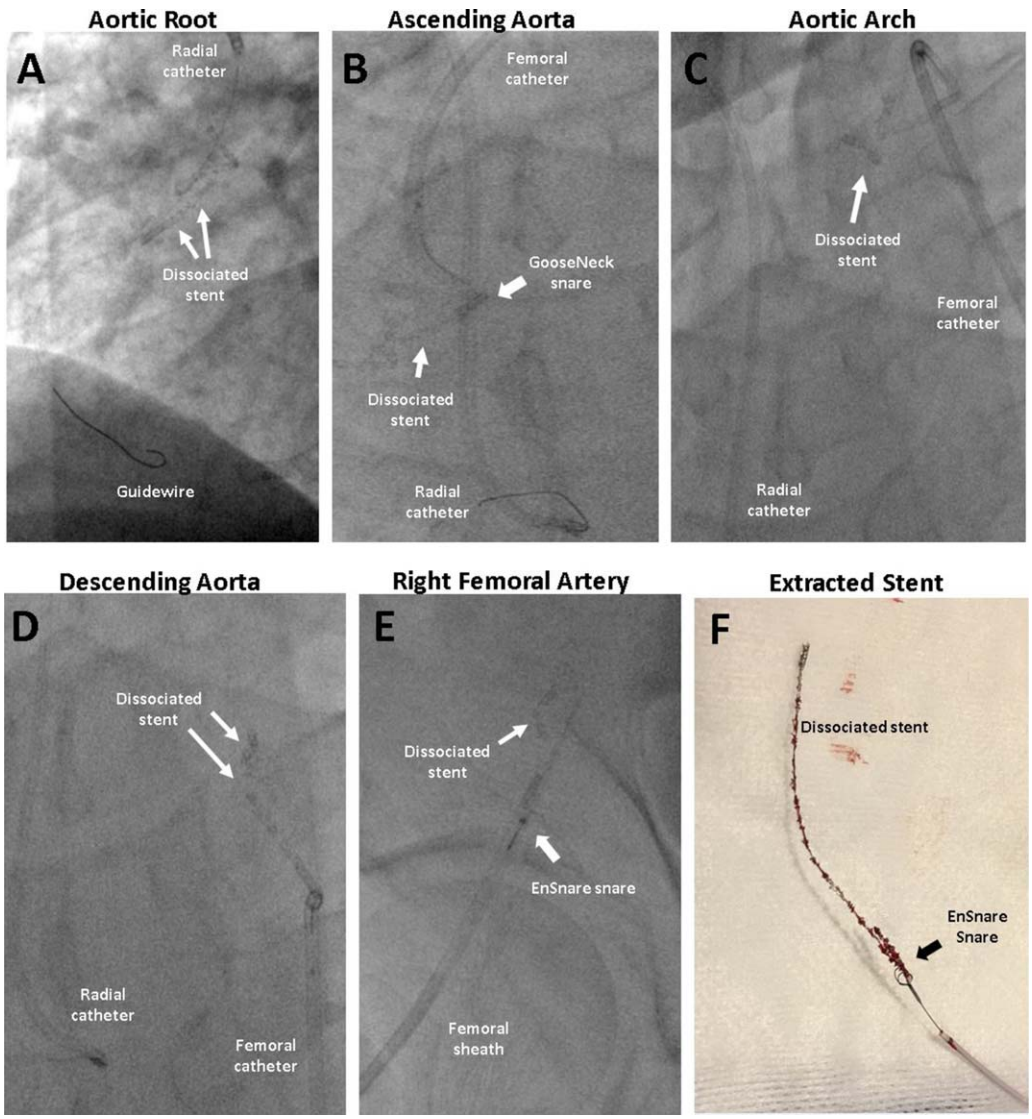

FIGURE 2 A, Dissociated stent; B, Stent retrieved into ascending aorta with the help of GooseNeck snare; C, Stent in aortic arch. D, Stent in descending aorta; E. Stent retrieved into right femoral sheath with the help of EnSnare snare; F, Successful extraction of stent [Color figure can be viewed at wileyonlinelibrary.com]

4 mm Snare Kit (Covidien, Dublin, Ireland) captured the stent near the RCA ostium and helped deliver the stent into the right femoral artery sheath and the EnSnare Endovascular Snare System 2–4 mm (Merit Medical Systems, South Jordan, UT) that helped pull the stent outside the sheath (Figure 2, Supporting Information Videos 1 and 2). By this point the patient had received close to 12 Gray air kerma radiation dose and a total of 350 mL of contrast and thus further intervention was not pursued. He remained hemodynamically stable throughout the procedure.

The patient had an uneventful recovery and was discharged from the hospital on aspirin, atorvastatin, metoprolol tartrate, and clopidogrel. He underwent successful PCI to the mid RCA one month later and has had no recurrent events eight months later. He did not develop any radiation skin injury.

3 | DISCUSSION

Stent loss during percutaneous coronary intervention is an infrequent and often challenging to treat complication, with an incidence of approximately 0.3% [1]. Stent loss can lead to stent embolization and coronary flow compromise causing myocardial infarction and death, or systemic embolization, for example into intracranial vessels potentially resulting in stroke or bleeding, or into the peripheral arterial system that usually does not cause any symptoms [1–3].

In a single-center retrospective analysis [1], stent loss occurred in 38 out of 11,773 PCIs performed between 1994 and 2004. In the same analysis, it was also reported that stent loss occurred more frequently in lesions with calcification and/or significant proximal angulation. In patients where the lost stent was crushed against the vessel wall, by the placement of another stent, no major cardiac complications were reported. Loop snare was used in 26% of cases to retrieve the stent. Patients who encountered stent loss had a higher incidence of bleeding requiring transfusion and emergent coronary artery bypass surgery. Another series reported 20 cases of stent loss among 2,211 patients who underwent implantation of 4,066 stents [2]. Stents were lost because the target lesion could not be reached or crossed. The same study also showed that stent retrieval with a 1.5 mm low-profile angioplasty balloon catheter was successful in 7 out of 10 cases whereas retrieval with a myocardial biopsy forceps or a gooseneck snare was successful in 3 out of 7 patients. Three patients underwent urgent coronary artery bypass graft surgery after unsuccessful percutaneous retrieval, and subsequently died. In two patients, the stents were crushed against the vessel wall with no adverse effect on coronary circulation, whereas in two cases the coronary stents were lost in the peripheral circulation without clinical consequences.

Stent loss can be approached either with stent deployment/crushing or with stent retrieval [1,2]. Stent deployment or crushing may often be the preferred approach as it is easier and faster to perform but should ideally be performed in a non-critical coronary segment (e.g., avoiding deployment within the left main coronary artery or at a bifurcation lesion). Maintaining guidewire position within the lost stent is critical for facilitating retrieval. The simplest stent retrieval technique

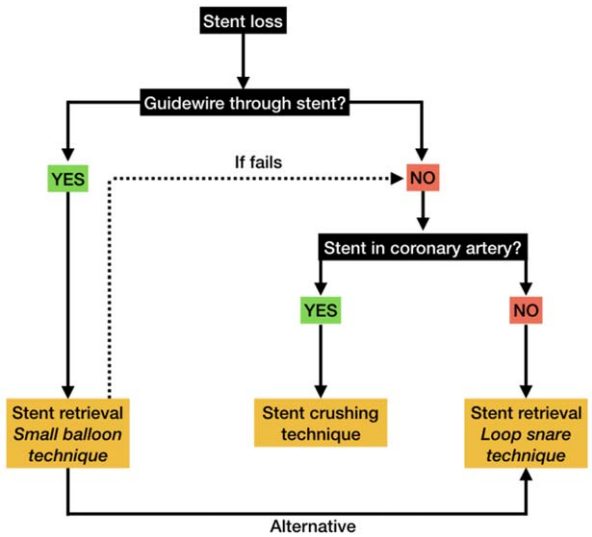

FIGURE 3 Proposed algorithm for coronary stent loss retrieval. [Color figure can be viewed at wileyonlinelibrary.com]

is the small balloon technique, in which a low profile balloon is advanced through the stent beyond its distal edge, inflated and withdrawn along with the stent into the guiding catheter [2]. A stent can also be retrieved using a loop snare (with one or three loops), which is extended through the guide catheter into the stent, which in turn is then snared and withdrawn [1]. Three-loop snares, such as the Ensnare or Atrieve (Argon Medical Devices, Plano, TX) are preferred for retrieval over the gooseneck snares. If no snare is available in the cardiac catheterization laboratory, a one-loop snare can be made by inserting a long guidewire through the catheter and then re-inserting the tip of the guidewire into the catheter. Alternatively, a guide catheter extension that contains an inflated balloon to trap the distal end of the guidewire can be utilized as well [4].

Treating stent loss can be facilitated by early detection, full understanding of the anatomy with the use of appropriate imaging, and formulation of a clear strategy, while maintaining flexibility as well as creativity during its execution. A proposed approach to stent loss is summarized in Figure 3. If the guidewire is still coursing through the lost stent, the best initial approach is retrieval with the small balloon technique, as was initially tried in our case. If the small balloon technique fails or if the wire position is lost, then a loop snare or stent crushing technique can be used depending on the location of the stent. Sometimes, a loop snare can be considered as the alternative default approach, even if the guidewire passes through the stent. One must be ready to modify the initial course of action or then cross over to a different strategy altogether as needed. Retrieval attempts should be always performed with caution as they may cause coronary artery injury.

4 | CONCLUSIONS

We present a challenging case of stent loss leading to the use of different techniques to successfully retrieve the stent. The first step after stent loss is to determine the need for retrieval versus deployment/crushing. The latter may be the preferred approach when the lost stent

is within a non-critical coronary artery segment [5–9]. If retrieval is pursued, the small balloon technique is often the first strategy, followed by use of a loop snare [1,5]. Operator experience, flexibility, creativity along with good imaging can help determine the optimal approach to coronary stent loss.

CONFLICTS OF INTEREST

None for Dr. Malik, Dr. Pompili, and Dr. Chatzizisis. Dr. Brilakis: consulting/speaker honoraria from Abbott Vascular, Amgen, Asahi, Elsevier, GE Healthcare, and Medicure; research support from Boston Scientific and Osprey; spouse is employee of Medtronic.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

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