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CORONARY, PERIPHERAL, AND STRUCTURAL INTERVENTIONS

CASE REPORT: CLINICAL CASE

Mechanical Barrier for Prevention of Dislodged Stent Embolization in Saphenous Vein Graft

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ABSTRACT

Percutaneous coronary interventions in vein grafts can be quite challenging, and many complications can occur during the procedure. We present a case of stent dislodgment during percutaneous coronary intervention in a vein graft. It was migrating to the proximal part of the graft and a covered stent was placed in the native vessel in order to isolate the graft. During follow-up, the position of the stent was evaluated by coronary computed tomography angiography. Dislocation of the stent from the balloon can cause undesirable effects. In cases of vein grafts, isolation of the graft could be an effective strategy for avoiding further difficulties. Coronary computed tomography angiography can be used for follow-up imaging. (JACC Case Rep. 2024;29:102577) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Complications in the cath lab can be challenging for every interventional cardiologist. We present a rare case of a 77-year-old man with non-ST-segment elevation myocardial infarction (NSTEMI) with a dislocated stent inside a saphenous vein graft (SVG) during percutaneous coronary intervention (PCI), ready to cause embolization.

TAKE-HOME MESSAGES

- Interventional cardiologists must always be resourceful and ready to face any complication in the cath lab during a PCI and take advantage of all the tools they have.
- Coronary CTA is a very useful noninvasive imaging method that can be used not only for diagnosis, but also as a follow-up method in these cases.

HISTORY OF PRESENTATION

A 77-year-old male patient was admitted to the emergency department due to chest pain and dyspnea. He was hemodynamically stable. Arterial blood pressure was 140/85 mm Hg, his heart rate was 80 beats/min, his respiration rate was 21 breaths/min, and his body temperature was 36.6 °C. Physical examination revealed only a systolic ejection murmur.

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ABBREVIATIONS AND ACRONYMS

CABG = coronary artery bypass grafting

CTA = computed tomography angiography

NSTEMI = non-ST-segment elevation myocardial infarction

OM = oblique marginal branch

PCI = percutaneous coronary intervention

RCA = right coronary artery

SVG = saphenous vein graft

PAST MEDICAL HISTORY

The patient was hypertensive and diabetic. Twelve years ago, a bifurcated synthetic graft was implanted due to common iliac aneurysm. Two years ago, after an NSTEMI he underwent coronary artery bypass grafting (CABG) surgery (left internal mammary artery to left anterior descending artery, SVG to right coronary artery [RCA], and SVG sequentially to the first and second oblique marginal branch [OM]).

DIFFERENTIAL DIAGNOSIS

The initial differential diagnosis included acute coronary syndrome without ST-segment elevation, aortic dissection, and pulmonary embolism.

INVESTIGATIONS

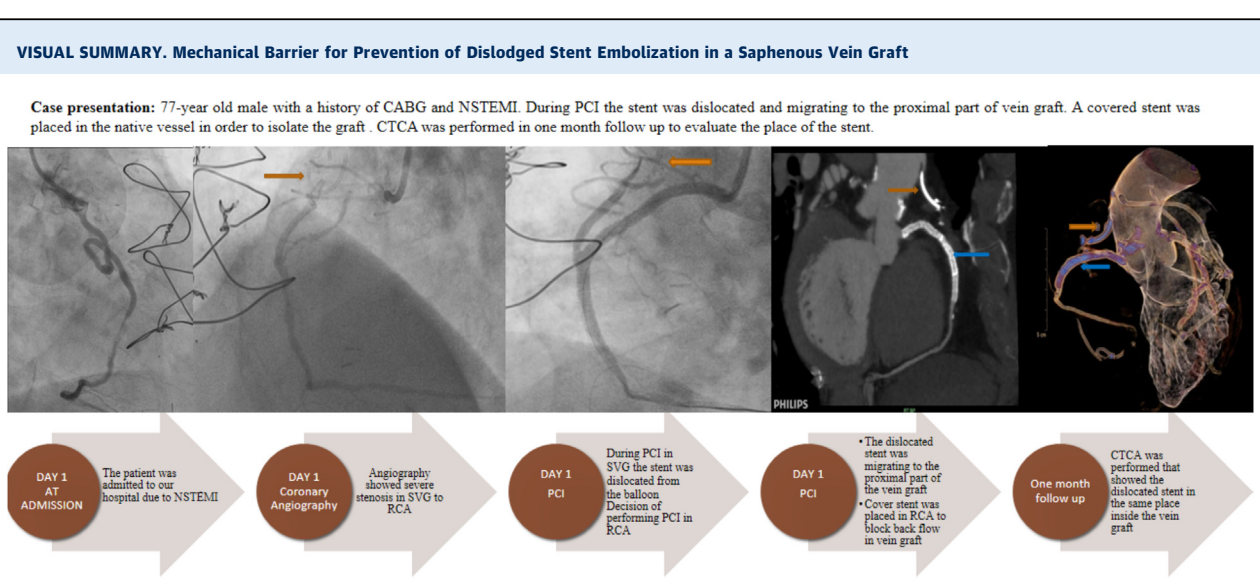
The electrocardiogram showed sinus rhythm with negative T waves in inferior leads. Chest x-ray film showed no specific abnormalities. Transthoracic echocardiography revealed preserved left ventricular (LV) systolic function, no regional wall motion abnormalities, and mild-to-moderate aortic stenosis. High-sensitivity cardiac troponin I was 1889.1 pg/mL and D-dimer was 0.79 mg/dL. Arterial oxygen saturation was 96% and arterial blood gas showed normal lactates (1.6 mmol/L).

MANAGEMENT

The patient was diagnosed with NSTEMI. Due to refractory chest pain to medical treatment (intravenous nitrates, intravenous pethidine, oral 300 mg aspirin, intravenous 5,000 IU unfractionated heparin), he was transferred to the cath lab. Coronary angiography via the left radial artery showed total occlusion of the mid left anterior descending artery, subtotal occlusion of OM1 and OM2, and severe stenosis of the mid RCA. Regarding the grafts, the left internal mammary artery and SVG to OM1 and OM2 were patent and without significant stenosis, while in the mid segment of the SVG to RCA a severe stenosis (90%) was shown (**Figure 1**, Video 1). It was decided to perform PCI in the diseased SVG because the lesion in RCA was long and calcified (**Figure 1**).

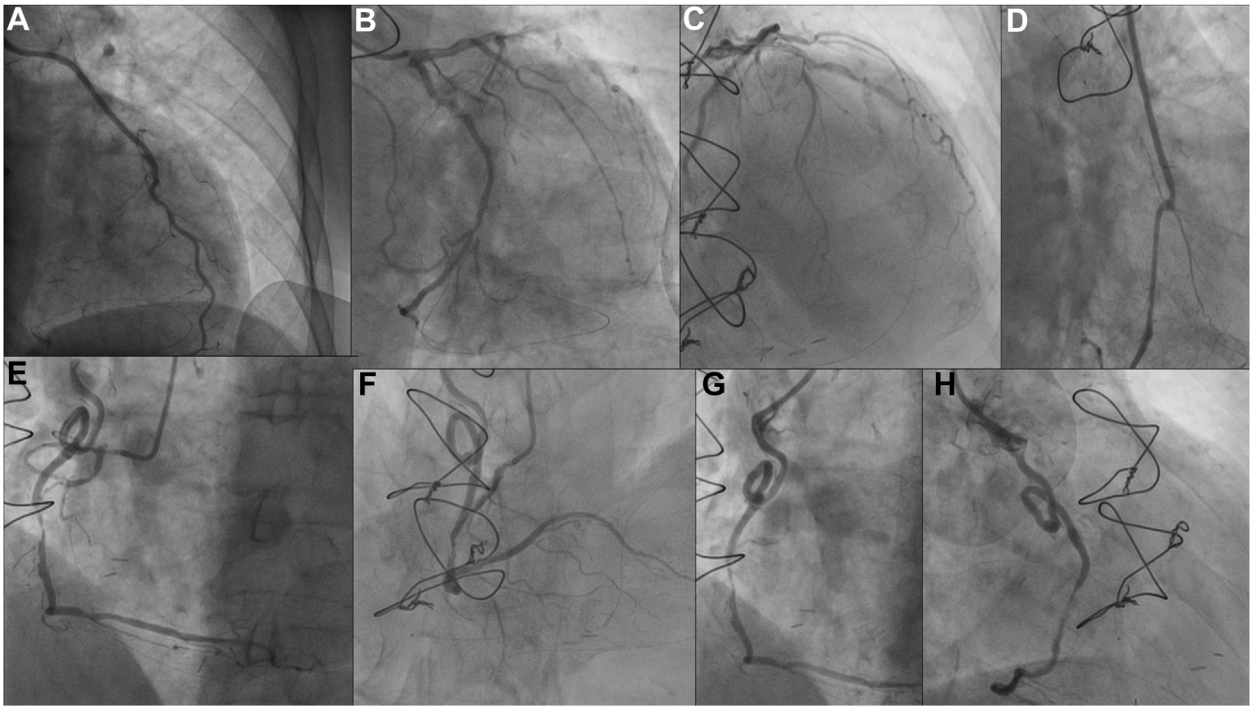
The SVG was engaged through a Multi-Purpose A1 catheter (Cordis) and a hydrophilic-coated polymer sleeve with a soft tip and flexible body guidewire was crossed distally. The mid part of the SVG was spiral and severely atheromatic. The lesion was predilated with a semi-compliant balloon (2.5 × 20 mm), and

VISUAL SUMMARY. Mechanical Barrier for Prevention of Dislodged Stent Embolization in a Saphenous Vein Graft



Brown arrows point to the dislocated stent; blue arrows point to the cover stent. NSTEMI = non-ST-segment elevation myocardial infarction; PCI = percutaneous coronary intervention; RCA = right coronary artery.

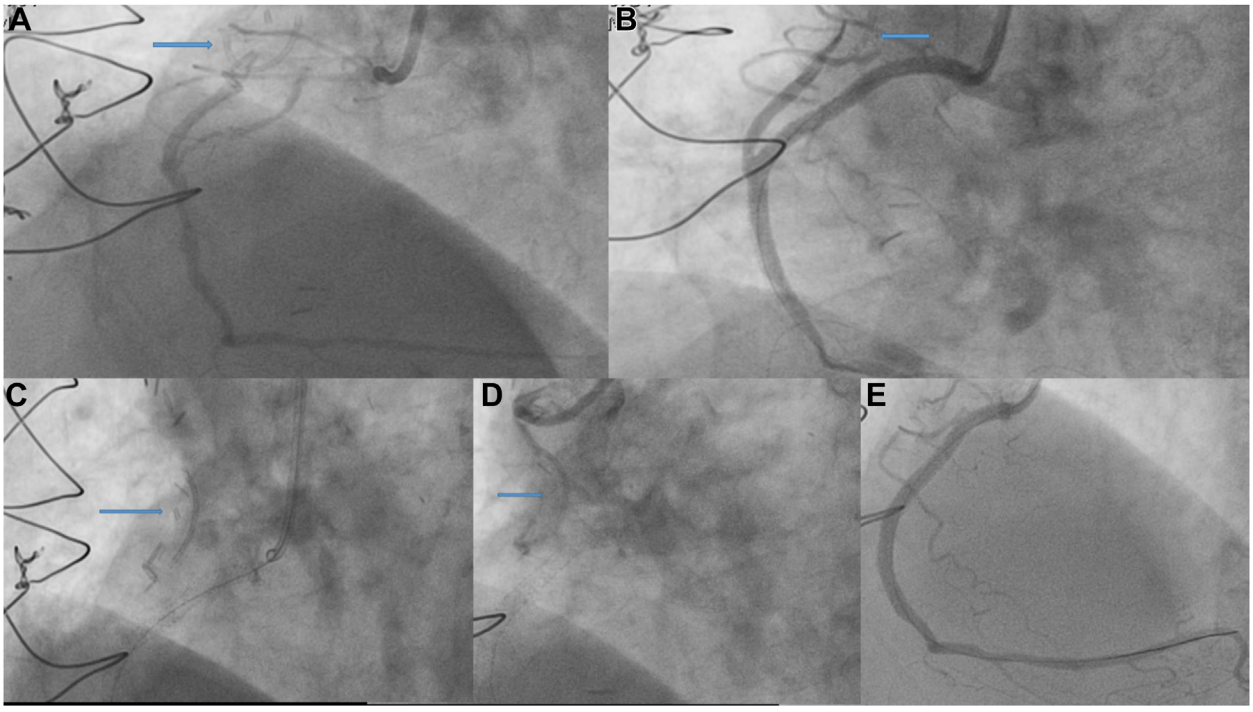
FIGURE 1 **Coronary Angiography of the Patient**



(A) Coronary angiography of left internal mammary artery and left anterior descending artery (LAD). (B) Coronary angiography of left circumflex artery. (C) Coronary angiography of the left anterior descending artery. (D) Coronary angiography of the saphenous vein graft–oblique marginal branch. (E, F) Coronary angiography of the right coronary artery. (G, H) Coronary angiography of the saphenous vein graft–oblique marginal branch showing severe stenosis.

then a drug-eluting stent (2.5 × 20 mm) was attempted to be delivered in the era of stenosis. After several unsuccessful attempts, the stent was dislocated from the balloon (Video 1). Despite the effort to dilate the stent with the balloon or to retrieve it, the stent became lodged in the spiral segment of the graft, making retrieval difficult. Then our decision was: 1) to perform PCI to the native RCA to achieve revascularization of the patient because this was the infarct-related artery; and 2) to stonewall the dislodged stent in a stable position avoiding thus any embolic complication. The RCA was engaged with a 6-F Judkins right 3.5 guide catheter with side halls and a new wire crossed the vessel up to the distal part (Video 2). The lesion was dilated with semi-compliant and non-compliant balloons and 2 overlapping drug-eluting stents (2.75 × 28 mm and 3.0 × 28 mm from the mid to ostial RCA) were put in place, and the anastomosis of the saphenous vein to the RCA was intentionally wrapped. Angiography showed that the dislocated stent was started moving upward to the proximal SVG and the aorta due to reverse flow coming from the native vessel (RCA) (Videos 3 and 4). X-ray screening without contrast showed the same movement of the stent, indicating that the force of contrast injection was not entirely responsible for stent migration. Then, it was decided to use a covered stent (stent graft 3.5 × 20 mm) to discontinue the communication between the RCA and SVG and stop the back flow by blocking the catalysis of the vein graft and imprisoning the stent inside the vessel (Video 5). The stent graft was dilated with a 3.5 mm noncompliant balloon. We decided not to pin the proximal end of the underplayed stent with covered stent because the proximal end of the 2 overlapping stents was placed covering the ostium of the RCA. Instead, we chose to wait for a while and confirm the absence of retrograde flow to SVG. The final angiography of SVG showed TIMI flow

FIGURE 2 **Percutaneous Coronary Intervention of the Right Coronary Artery**



(A) Dislocated stent in the saphenous vein graft (SVG). (B) Angiography of the right coronary artery after stenting showing back flow in SVG. (C) the dislocated stent migrating to the proximal part of the vein graft. (D) Final angiography of SVG showing the entrapped dislocated stent and TIMI flow grade 1 of the vessel. (E) Final coronary angiography of the right coronary artery after deploying the cover stent with no back flow in SVG. Blue arrows point the dislocated stent.

grade 1 and the previous dislocated stent in the same position (**Figure 2**, Videos 6 and 7).

OUTCOME AND FOLLOW-UP

The patient was transferred to the Cardiac Care Unit for intensive monitoring for 2 days and stayed in the hospital for a total of 5 days, remaining stable (troponin levels were gradually decreased, serial transthoracic echocardiograms showed a left ventricular ejection fraction of 55% with no regional wall motion abnormalities, and the electrocardiogram did not change since admission). The patient was discharged with dual antiplatelet therapy (aspirin 100 mg once daily, clopidogrel 75 mg once daily), statin (rosuvastatin 40 mg once daily) and ezetimibe (10 mg once daily), beta-blocker (metoprolol 25 mg twice daily), and eplerenone (25 mg once daily).

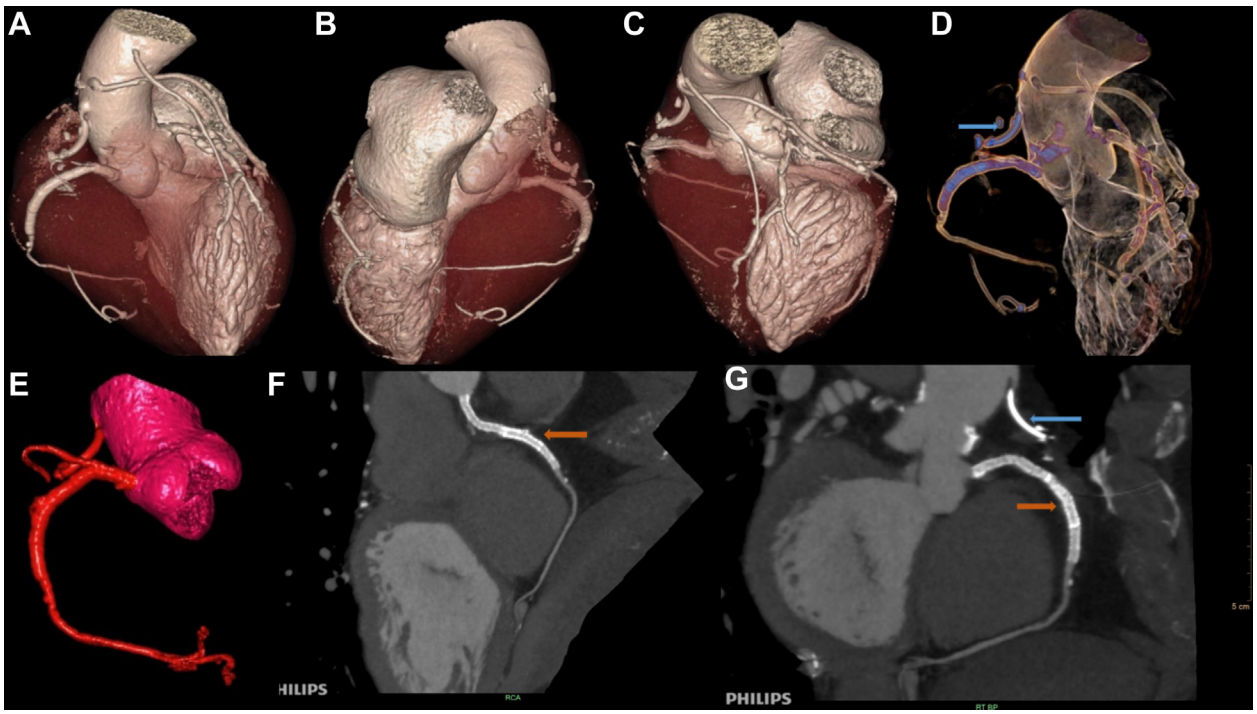
At 1-month follow-up, the patient was clinically stable (NYHA functional class II), the echocardiogram showed a left ventricular ejection fraction of 55%, and no arrhythmias in a 24-hour electrocardiographic monitoring (Holter) were recorded. He was advised to perform a coronary computed tomography angiography (CTA) to evaluate the place of dislocated stent. The coronary CTA and 3-dimensional reconstruction of the coronary arteries showed the total occluded SVG to RCA with the stent remaining inside the vessel (**Figure 3**).

DISCUSSION

During PCI, an interventional cardiologist can face various complications, such as dissection, slow flow or no reflow, perforation, unexpected hemodynamic collapse, and dropped equipment inside the coronary arteries.[1]

Entrapped material (guidewires, dislocated stents, atherectomy burr, microcatheters, balloons, laser tips, and other equipment) inside coronary arteries is a rare but severe and challenging complication during PCI. Sometimes, interventionists should consider leaving the entrapped equipment inside the vessel if

FIGURE 3 **Coronary CTA of Patient at 1-Month Follow-Up**



(A to C, E) Coronary computed tomography angiography (CTA) and 3-dimensional reconstruction of coronary arteries. (D) Coronary CTA with 3-dimensional reconstruction of the right coronary artery showing the covered stent and the entrapped dislocated stent in vein graft. (F) Coronary CTA (multiplanar reconstruction) showing the covered stent. (G) Coronary CTA (multiplanar reconstruction) showing the dislocated stent inside the saphenous vein graft and the covered stent in the right coronary artery. Blue arrows point to the dislocated stent and brown arrows show the cover stent.

removal is impossible or if there is high risk of migration to a part of the body that can cause severe complications.[1]

This was a case of a dislodged stent from the balloon, inside a spiral and severely atheromatic part of an SVG. There are various ways (or mainly 2 ways) to deal with this complication and avoid the risk of thrombosis or migration of the stent: 1) crushing the stent in the wall; or 2) snaring of the stent. In the aforementioned case, due to the complex anatomy of the vessel (spiral and severely atheromatic) and high risk of migration and embolic events, it was very difficult to deploy it or stent it in the vessel wall as well as snare it from the part of the vessel where it was stacked.[1,2] In order to avoid the higher complications owing to the use of coronary covered stents compared with other stents (higher in-stent restenosis and stent thrombosis), we put initially drug-eluting stents as a physical barrier between the RCA and SVG.[3] However, the dislodged stent was continuing to move toward the aorta due to competitive flow of the RCA, and we decided to block the flow to the SVG with a cover stent over the drug-eluting stent in the RCA and trap the dislodged stent in the SVG.

Covered stents are used to seal coronary artery perforation, which is a rare but potentially dangerous complication that usually occurs during PCI.[4] There is also an option for the exclusion of coronary aneurysms or fistulas.[3] Although these stent have the theoretical advantage to trap embolic debris, especially in friable and degenerated lesions, as lesions in SVGs, studies have shown that their use resulted in similar to or worse outcomes than bare-metal stents.[3] Moreover, the unacceptable stent thrombosis rate does not allow the use of covered stents in other indications.[5]

Invasive angiography is the gold standard diagnostic method for detecting coronary artery disease; however, coronary CTA can also be used as a noninvasive imaging method of coronary arteries and grafts, providing anatomical information that may have prognostic value on procedural outcomes, especially in patients with chronic total coronary

artery occlusions. It seems that coronary CTA prior to invasive coronary angiography in CABG patients reduces the time and complications of the procedure as well as the amount of contrast that should be administrated to the patient.[6,7] On the other hand, coronary CTA can play a different role, as it can also be used as a follow-up method of operative and postoperative complications.[8,9] Our patient was an elderly male, so the heart team decided that the best option and more convenient method to evaluate his coronary arteries and the precise location of the dislocated stent was to perform a coronary CTA, thus avoiding graft seeking and complications. The method is highly accurate at detecting the location of grafts and if they are patents or occluded. The position of stents is easily accomplished.

CONCLUSIONS

When interventional cardiologists deal with elderly people with many comorbidities and especially CABG, they may come across many challenges, and thus they must be always ready to solve every complication because every case is different. One of these complications is the dislocation of the stent from the balloon, which can have many undesirable effects for the patient (from thrombosis of the vessel to embolic events). Cover stents are a great ally in interventionists' weaponry that can have different uses. Coronary CTA seems to be a useful noninvasive imaging method that may help evaluate and treat patients in cases such as this one.[10]

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KEY WORDS covered stent, coronary CTA, stent dislodgement, vein graft

APPENDIX For supplemental videos, please see the online version of this paper.