Embolism of a Fully Expanded Right Coronary Ostium Stent to the Right Brachial Artery During Radial-Access Percutaneous Coronary Intervention

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ABSTRACT: Stent embolism is a rare complication of percutaneous coronary intervention (PCI), usually encountered when an undeployed stent unintentionally dislocates from the balloon. There is little published literature regarding incidence or clinical outcomes of embolism of deployed coronary stents. We report the case of a 56-year-old male who had embolism of a fully-deployed stent from the right coronary ostium to his brachial artery during PCI. This was managed conservatively without any clinical events after 12 months.

CASE PRESENTATION

A 56-year-old male was admitted with non-ST-elevation MI (nSTEMI). His cardiac risk factors included being an ex-smoker, type 2 diabetes mellitus, and hypertension. His ECG showed normal sinus rhythm with no localizing acute change. Troponin I was elevated at 0.81 (normal reference <0.04). He was commenced on standard treatment for nSTEMI, including aspirin and ticagrelor. His echocardiogram showed good left ventricular systolic function with mild left ventricular hypertrophy. An angiogram was performed, which showed long diffuse moderate disease of his left anterior descending (LAD), and a long segment of severe disease in the proximal-mid right coronary artery (RCA), which was felt to be the likely culprit. In view of multivessel disease and diabetes, his case was discussed at our heart team meeting, where it was felt that either percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) were reasonable options, with a possible prognostic advantage for CABG.

TREATMENT

The patient chose PCI. We agreed to perform PCI to the culprit RCA and not to intervene on the LAD unless evidence of ongoing ischemia was present. Arterial access was gained via the right radial artery; intra-arterial verapamil 2.5mg was given to prevent vasospasm. He received periprocedural bivalirudin intravenous infusion for anticoagulation.
A 6 Fr Amplatz left (AL) 0.75 Launcher guide catheter (Medtronic) was used to engage the RCA, and the diseased segment was crossed with a Sion Blue 0.014” wire (Asahi). The proximal and mid RCA were predilated with a 2.5 mm x 20 mm Maverick balloon (Boston Scientific Corp), and a 3.5 mm x 38 mm Resolute Integrity drug-eluting stent (Medtronic) was deployed in the mid RCA followed by an overlapping 3.5 mm x 34 mm Resolute Integrity drug-eluting stent proximally. It appears that there was geographic miss of the RCA ostium and a possible proximal edge disruption (Figure 1) so a 4 mm x 9 mm Resolute Integrity stent was deployed at the RCA ostium, intending to overlap the proximal RCA stent. However, on inflation the stent appeared to slip proximally. Immediately post deployment there was a possible gap between the stents and the 4 mm x 9 mm stent was seen to be protruding from the ostium, with only the distal end of the stent within the RCA ostium (Figure 2). All stents were postdilated with a 4 mm x 20 mm Quantum balloon (Boston Scientific Corp) to 16 atmospheres. Following post-dilatation, the ostial RCA stent vanished and was assumed to have displaced out of the RCA, but it could not be seen in the aortic root. An additional 4 mm x 9 mm Resolute Integrity stent was deployed to the RCA ostium with good result.

The displaced RCA stent was found to have migrated over the guide catheter to the right subclavian artery (Figure 3). After considering the risks/benefits of conservative management vs percutaneous extraction or surgical removal, we decided to maneuver the stent into a more stable distal location where it might anchor and endothelialize. An uninflated 5 mm x 8 mm Quantum balloon was deployed distal to the guide catheter (Figure 3), and the AL 0.75 guide was retracted slowly with the stent and kept under constant fluoroscopic visualization. As the guide was retracted, the stent moved distally to the mid-brachial position, where it
remained unapposed. The 5 mm x 8 mm Quantum balloon was inflated to 5 atmospheres within the stent, and gentle traction was applied to the balloon until the stent lodged in the distal brachial, just proximal to the radial-ulnar bifurcation. The stent was then expanded with the 5 mm x 8 mm Quantum balloon to 16 atmospheres. Angiography showed the stent to be adequately sized to the brachial artery and normal antegrade flow was present (Figure 4). Catheter, balloon, wire, and sheath were all removed and radial hemostasis was achieved using a TR Band (Terumo).

The patient remained hemodynamically stable and asymptomatic throughout the procedure and up to the point of hospital discharge. A Bruce protocol exercise test was performed prior to discharge to screen for residual ischemia in the LAD; he exercised for 9 minutes and 20 seconds, reaching 82% maximum predicted heart rate in Stage 4 with no symptoms except fatigue.

The case was discussed in our vascular multidisciplinary meeting, where a conservative strategy was agreed upon as appropriate in the absence of vascular compromise. He was reviewed electively by the vascular surgeons 2 months after PCI, with normal palpable radial and ulnar pulses and duplex scan showing normal multiphasic flow all the way to the wrist. The patient was reviewed at 9 and 14 months post PCI without any cardiac or arm symptoms. The LAD disease did not require any intervention. The embolized stent to the right brachial artery had been successfully managed conservatively.

**DISCUSSION**

Coronary stent embolism occurs when a coronary stent is unintentionally dislodged into the coronary

![Figure 3. PA view of 4 mm x 9 mm Resolute Integrity stent (Medtronic) surrounding the guide catheter in right subclavian artery (red arrow), having embolized from the RCA ostium.](image)

![Figure 4. PA view of 4 mm x 9 mm Resolute Integrity stent (Medtronic) in final position within right brachial artery (red arrows), proximal to radial and ulnar bifurcation.](image)
tree or into the systemic circulation. The incidence of stent embolism has been reported to be in the region of 0.32% to 8.4%. In one study, 5 patients out of 2,338 cases of PCI had stent embolism. The vast majority of reported cases involve undeployed stents dislodging from the balloon, and this problem is most commonly encountered when treating severely calcified lesions, angulated lesions, underexpanded stents, small short stents, primary stenting, manual handling of the stent, and stent type. Premounting technology also affects the incidence of this type of stent embolism.

There are several reports describing outcomes of intracoronary stent embolism but only a few on systemic stent embolism. The risk of serious adverse in-hospital events is significant if an undeployed embolized intracoronary stent is not retrieved. However, adverse events may be less frequent when stents embolize to the peripheral circulation, with some advocates of conservative management, while others advocate early stent removal due to the risk of limb ischemia. In a case series of 20 patients with coronary stent embolism, only 2 patients had embolization to the periphery and both were managed conservatively without any clinical consequence. In another case series of 23 patients with stent embolism, 7 patients had stent embolism to the central or peripheral circulation. One patient demonstrated possible peripheral vascular insufficiency.

Embolization of deployed coronary stents is rare, but has the potential to cause significant events such as stroke. Our case describes a fully deployed coronary ostium stent dislodging and embolizing over the 6 Fr guide catheter during radial-access PCI into the brachial artery where we achieved a secure coaxial position, maintaining normal arterial flow and no clinical consequence after 14 months of follow-up, avoiding the need for percutaneous or surgical removal. Factors that may have contributed to stent dislodgement in this case include the short length of the stent (9 mm), with the stent slipping proximally on deployment, the AL curve on the guide catheter exerting nonaxial force on the protruding stent during cardiac and respiratory motion, and the post dilatation balloon being withdrawn from the coronary artery.

CONCLUSION
Extracoronary stent embolization is a rare complication of PCI, with few reports to guide management of embolized fully expanded stents. This case demonstrates a good outcome from conservative management of a fully expanded RCA ostium stent into the right brachial artery during radial access PCI.

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