Difficult Stentablation with an Episode of Stuck and Entrapped Burr within the Underexpanded Stent

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Summary
Stentablation by rotational atherectomy has been reported as an option to correct underexpanded stents. Due to concerns of excessive stent damage, distal embolization of metal particles, excessive heat generation, and burr entrapment in the stent, stentablation has been considered the last choice to manage underexpanded stents. Here, we report a case of a stuck and entrapped atherectomy burr inside an underexpanded and undilatable stent, which made withdrawal of therotablation burr during rotational atherectomy difficult. After successful stentablation by rotational atherectomy, we were able to complete the percutaneous coronary intervention with another stent.

Key words: Underexpansion, Rotational atherectomy

There are several potential complications when performing percutaneous coronary intervention (PCI) of heavily calcified lesions. These include difficulty of wire engagement and stent insertion into the stenotic lesion, slow flow phenomenon, stent underexpansion, and coronary perforation. Of these, stent underexpansion is a well-known risk factor that increases the risk of stent thrombosis and restenosis.1

If there is a calcified lesion with insufficient expansion after ballooning with non-compliant balloons, rotational atherectomy (RA) is one of the available options for pretreatment of calcified plaques.2-6 RA might also be used to remove an underexpanded stent. However, there are several problems associated with RA for removal of underexpanded stents. Here we report a case of a stuck and entrapped atherectomy burr inside an underexpanded and undilatable stent, which made difficult withdrawal of the rotablation burr during RA.

Case Report
An 81-year-old man with a history of hypertension and known obstructive coronary artery disease reported continuous chest pain and was diagnosed with non-ST elevation myocardial infarction (NSTEMI). Electrocardiogram (ECG) revealed ST-segment depression in the V3-6 leads. The patient had been previously treated with PCI three times due to a severely underexpanded stent (Promus Premier 2.75 × 24 mm; Boston Scientific, Natick, MA, USA) in the left anterior descending coronary (LAD) artery that had not been corrected with standard balloon techniques (Figure 1A).

A coronary angiography revealed total occlusion within the prior underexpanded stent at the mid-LAD artery lesion (Thrombolysis in Myocardial Infarction (TIMI) flow 0). After balloon dilatation, TIMI grade 3 flow was restored. However, the attending physician did not fully dilate the underexpanded stent despite multiple balloon inflations with a non-compliant balloon (2.5 × 12 mm), which was inflated up to 24 atmospheres (Figure 1B). After conservative treatment for 5 days, RA was used to ablate the unexpanded stent and the underlying calcified plaque with on-site surgical backup. A 7F EBU 4 guiding catheter (Medtronic, Minneapolis, MN, USA) was engaged into the left main coronary artery through the right radial artery. Intravascular ultrasound (IVUS) catheter (Boston Scientific, Natick, MA, USA) could not pass the lesion. After introduction of a conventional 0.014-inch guidewire to the distal portion of the LAD artery using the support with a microcatheter (Finecross; Terumo Comp., Tokyo, Japan), a 0.009-inch rotablation wire (RotaWire® Extrasupport; Boston Scientific, Heredia, Costa Rica) was introduced. RA was performed with a 1.25-mm-sized burr (RotaLink® Plus; Boston Scientific, Cork, Ireland). There was resistance while introducing the burr at the narrowest area of the stent (Figure 2A), and the burr was suddenly stuck with an abnormal rotational sound. The rotational speed was decelerated to less than 80,000 rpm, and additional high and low speed rotational attempts failed. The operator carefully tried to withdraw the burr to prevent the breakdown of the burr head while preventing passive engagement of the guiding catheter.
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Figure 1. A: Previous angiogram shows a severe underexpanded stent (dog-boning appearance, arrow) at the left anterior descending coronary artery in the anteroposterior cranial projection. B: The underexpanded stent was not dilated despite multiple balloononing attempts with a non-compliant balloon. C: Final angiography reveals the fully expanded stent without residual narrowing in the right anterior oblique cranial projection.

Figure 2. A: The burr did not advance at the narrowest portion within the stent and was entrapped inside the stent. B: The entrapped burr was extracted from the underexpanded stent using deep intubation of the guiding catheter just proximal to the stent (arrow).

into the proximal LAD artery (Figure 2B). Then, the burr was suddenly withdrawn into the guiding catheter. The operator repeatedly performed atherectomy despite entrapment of the burr. After several attempts, the burr was not stuck anymore and passed easily through the lesion without resistance.

A 1.5-mm-sized burr was used instead of the 1.25-mm-sized burr to gain a larger luminal area. However, the burr became stuck once again and manual withdrawal was repeatedly attempted. Because the withdrawal of the 1.5-mm burr was more difficult, the guiding catheter damaged the proximal stent strut due to deep passive engagement of the guiding catheter. After several attempts, the 1.5-mm burr passed through the lesion without resistance or speed drop. A subsequent angiogram revealed slow coronary flow to the LAD artery with partial longitudinal stent compression at the proximal edge and focal distal stent edge dissection. IVUS demonstrated that the narrowest part of the underexpanded stent after RA was 1.4 × 1.5 mm in diameter (Figure 3A). The operator could obtain acceptable expansion of the stent using a 2.5 × 8.0 mm non-compliant balloon (NC Emerge™; Boston Scientific, Maple Grove, MN, USA) at 24 atmospheres. Then, a 2.5 × 38 mm long Synergy stent (Boston Scientific, Natrick, MA, USA) was placed through the prior underexpanded stent to cover an area extending from the damaged proximal portion to the distal dissected area. Additional high-pressure balloon dilatation was performed with a 2.5 × 8 mm balloon at 20 atmospheres. Kissing balloon dilatation was performed with a 2.5 × 8 mm balloon for the LAD artery and a 2.0 × 15 mm balloon for the diagonal artery. A final angiography showed a fully expanded stent without residual narrowing (Figure 1C), and the region of interest after additional balloon angioplasty on IVUS was 2.1 × 2.2 mm (Figure 3B). On the following day, the ST-segment depression of the ECG was normalized and there
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Figure 3. A: Intravascular ultrasound (IVUS) after stentablation by rotational atherectomy (RA) shows that the narrowest part of the underexpanded stent after RA was 1.4 × 1.5 mm. B: IVUS after reintervention demonstrates an acceptable lumen diameter (2.1 × 2.2 mm).

Discussion

In this case report, we demonstrate the use of RA as an option to correct an unexpanded coronary stent associated with a severe calcific coronary lesion. The RA attempts were difficult due to severe calcification, and the burrs became stuck.

RA is a valuable method to obtain sufficient passage for stenting in difficult-to-dilate, heavily calcified lesions with standard balloon angioplasty. Several authors have reported that RA followed by stent implantation is a feasible method in terms of high rate of procedural success and favorable long-term outcomes in heavily calcified coronary lesions. It is difficult to recognize underexpansion of the balloon and adequate lesion preparation before stenting. IVUS before stenting can help to avoid underexpansion of the stent without sufficient lesion preparation.

In this case, we performed stent deployment at a heavily calcified lesion after conventional balloon angioplasty at the time of first PCI, which resulted in a severely underexpanded stent at the lesion and NSTEMI in this patient. As the attending physician did not obtain sufficient expansion with several episodes of balloon dilatation, stentablation by RA was attempted because the patient refused coronary artery bypass graft surgery. Stentablation by RA has been reported since 2001 as an option to resolve unexpanded stents. There are concerns regarding excessive stent damage, distal embolization of metal particles, excessive heat generation, and burr entrapment in the stent; based on this, all authors have agreed that stentablation is the last choice to manage an underexpanded stent. Khan, et al. reported emergency surgical extraction of an entrapped burr within the stent at a mid-LAD artery lesion. The authors emphasized the importance of avoiding this serious complication and of performing this RA procedure in a center with cardiac surgeons on standby. Edes, et al. showed that stentablation by RA increases post-procedural major adverse cardiac events and mortality rates.

Technical considerations for stentablation by RA were recommended in a previous report. Slow, delicate, and gradual movement of a smaller diameter burr is required to avoid excessive deceleration (> 5,000 rpm) and burr entrapment. During the procedure, intracoronary imaging is mandatory, and the novel stent should cover the entire ablated portion of the lesion. In the present case, burr entrapment within the stent occurred several times despite the slow and gentle advancement using a small-sized burr (1.25 mm). We were able to extract the burr from the lesion using deep intubation of the guiding catheter, which was recommended at the European expert consensus on RA.

Conclusion

Stentablation by RA could be considered a last resort for correction of an unexpanded stent, but there are several concerns regarding complications, including burr entrapment within the stent, as reported in the present case. We emphasize the need for proper lesion preparation before stent deployment as well as for following the recommendation when performing the stentablation by RA.

Disclosures

Conflicts of interest: None declared.

References


