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CASE REPORT

Double stent fracture and in-stent restenosis due to nodular calcification treated with Shockwave coronary intravascular lithotripsy

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Abstract

We describe the fracture of a double layer of stents caused by nodular calcification. This resulted in recurrent in-stent restenosis, which was treated with Shockwave coronary intravascular lithotripsy.

KEYWORDS

calcification, optical coherence tomography, Shockwave lithotripsy, stent failure

1 | INTRODUCTION

Coronary calcification causing extrinsic stent deformation and fracture is a particularly challenging and uncommon cause of stent failure. Shockwave coronary intravascular lithotripsy (IVL) provides a new option for the treatment of in-stent restenosis caused by extrinsic calcification.

2 | CASE REPORT

An 89-year old lady known with coronary artery disease presented in May 2019 with recurrent crescendo angina symptoms. In 2011, she underwent percutaneous coronary intervention (PCI) of the proximal right coronary artery (RCA) with implantation of a 3.0 × 16 mm Promus-Element (Boston Scientific, Marlborough, MA) drug-eluting stent (DES), which was postdilated at 20 atm with a noncompliant (NC) balloon. Six months later she presented with in-stent restenosis, which was treated with the application of a 3.0 × 20 mm drug-eluting balloon (SeQuent Please, B. Braun, Melsungen, Germany). In 2013, she presented again with in-stent restenosis (Figure 1, Panel A). Optical coherence tomography (OCT) determined that a large burden of underlying calcium (nodular calcification) was the cause for stent failure (Figure 1, Panel A', asterisk). This was treated with a 3.0 × 18 mm Biofreedom (Biosensors, Morges, Switzerland) DES (Figure 1, Panel B). Postdilatation was performed with a NC balloon at 26 atm and OCT confirmed an acceptable result (minimal stent area 8 mm^2) (Figure 1, Panel B′).

Coronary angiography (Figure 1, Panel C) and OCT (Figure 1, Panel C′) during the current admission demonstrated RCA in-stent restenosis due to expansion of calcium causing a fracture of both earlier implanted stents (Figure 1, Panel E, asterisks in the rendered stent image identify the calcium and the fractured stents). The lumen had become very narrow (minimal lumen area 2.07 mm^2), and the calcium had expanded, pushing in and causing fracture of both stents. Despite preparation with several noncompliant and cutting balloons inflated at high pressures, the nodular calcification would not allow adequate re-expansion of the double layer of stent struts. A Shockwave coronary IVL balloon catheter (Shockwave Medical, Santa Clara, CA) was then used according to manufacturer's instructions for use (3.0 × 10 mm balloon with 8 × 10 sequential pulse treatments). After treatment with the Shockwave balloon, a better expansion of the two layers of stents was obtained and subsequently an additional 3.25 × 18 mm Xience Sierra (Abbott, Santa Clara, CA) DES was implanted, which was postdilated with a NC balloon at 30 atm. The final result, after Shockwave, NC balloon inflation at 30 atm, Wolverine cutting balloon (Boston Scientific) inflated at 16 atm, stent implantation and postdilatation with the same NC balloon, was not yet optimal (lumen 4.5 mm^2), but the best achievable (Figure 1, Panel D, D', and F, asterisks show the residual calcium). Although it is known that coronary IVL modifies coronary calcified plaque by causing fractures in the calcium, in this case, due to the double stent layer, it was unfortunately not possible to identify fractures in the peri-stent calcium or to quantify the remaining burden of calcium outside of the stented segment.

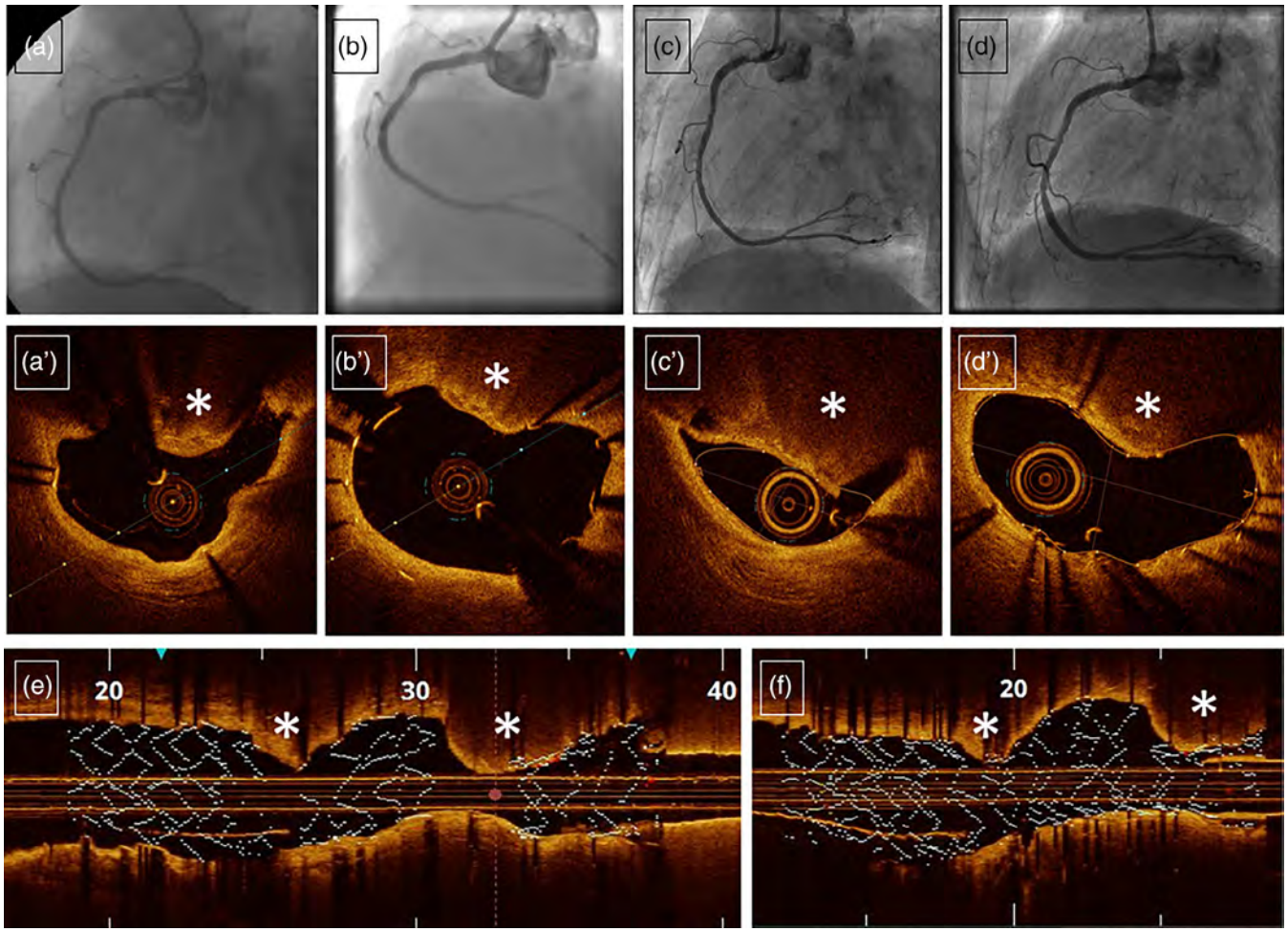

FIGURE 1 Panel A: Recurrent in-stent restenosis in the proximal right coronary artery (RCA). Panel A': optical coherence tomography (OCT) determined that a calcified nodule (asterisk) was the cause for stent failure. Panel B: coronary angiography after treatment with a second drug-eluting stent (DES). Panel B′: OCT after implantation of a second DES showing residual calcified nodule (asterisk). Panel C: coronary angiography showing recurrent in-stent restenosis. Panel C′: OCT images demonstrating RCA in-stent restenosis due to expansion of calcium (asterisk) causing a fracture of both earlier implanted stents. Panel D: final angiographic and OCT (Panel D') result after treatment with noncompliant, cutting balloons and Shockwave lithotripsy. Panel E: OCT-rendered stent image at the same time point as Panel C′; asterisks identify the calcium and the fractured stents. Panel F: final OCT-rendered stent image at same time point as Panel D' demonstrating residual calcified nodule (asterisks) [Color figure can be viewed at wileyonlinelibrary.com]

3 | DISCUSSION

To our knowledge, this is the first case of a double stent fracture caused by nodular calcification treated with Shockwave therapy. The Shockwave Medical coronary IVL catheter is a single-use sterile disposable catheter that contains multiple lithotripsy emitters enclosed in an integrated balloon.[1] It emits sonic pressure waves in a circumferential field causing the selective fracture of calcium, altering vessel compliance and permitting further expansion of the vessel wall. This provides an advantage over rotational atherectomy when dealing with calcium in already-stented segments, since the calcium under the stent struts can be disrupted using the intraluminal balloon catheter. Excimer laser coronary angioplasty (ELCA) has also been reported to be useful in the treatment of stent underexpansion due to peri-stent calcification.[2] This is due to the conversion of water into exploding vapor bubbles, which can fracture peri-stent calcium. In our case, persistent nodular calcification continued to grow behind two layers of stents causing fracture of both stents and recurrent in-stent restenosis. Although optimal disruption of calcium is best achieved, and only recommended, when the coronary calcification is circumferential, Shockwave lithotripsy has been used successfully in cases with focal eccentric calcification.[3] Shockwave lithotripsy provides an additional option in these difficult cases.

4 | CONCLUSION

Shockwave coronary IVL provides an additional option for the treatment of in-stent restenosis caused by extrinsic calcification.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of this article.

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