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Impressive late stent recoil of a drug-eluting resorbable magnesium coronary stent

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Summary

A 69-year-old female patient previously treated for a non-ST-elevation myocardial infarction with implantation of a drug-eluting resorbable magnesium stent (RMS) in the right coronary artery (RCA) was readmitted after 8 months because of unstable angina. The coronary angiograms showed a severe focal restenosis of the RMS previously implanted in the RCA. Coronary intravascular ultrasound did not show any significant intraluminal proliferation but demonstrated an impressive late stent recoil.

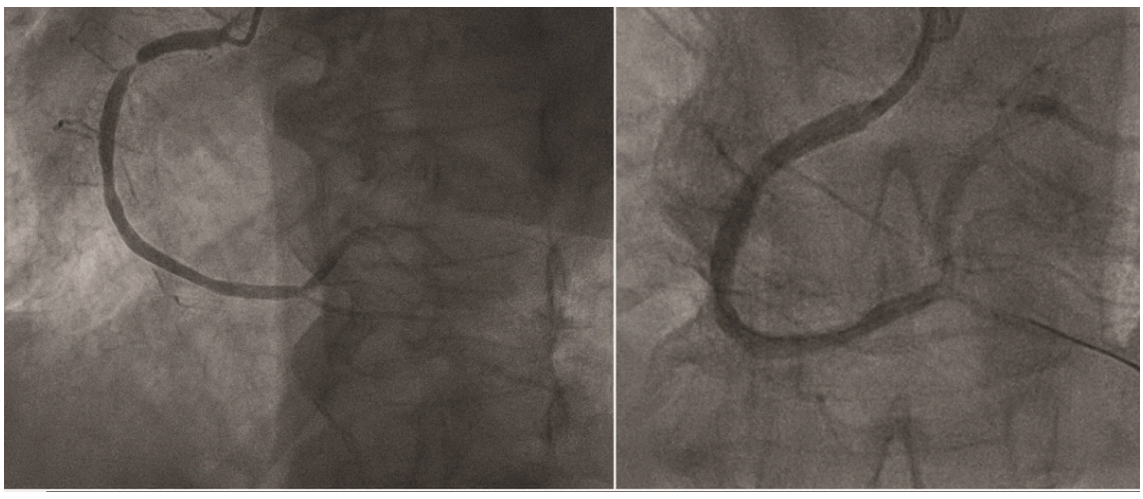
Keywords: *stent recoil, resorbable drug-eluting stent, IVUS*

Case description

A 69-year-old female patient, with mild hypertension, dyslipidaemia and type two diabetes on oral therapy, was admitted to our institution with a non-ST-elevation myocardial infarction. Coronary angiography showed a narrow stenosis of the proximal right coronary artery (RCA). No calcification was detected by angiograms (type A stenosis according to the Ellis classification). Subsequently, percutaneous intervention (PCI) was performed with implantation of a 3.0 × 15 mm drug-eluting resorbable magnesium stent (RMS) in the RCA; PCI was accomplished according to the current manufacturer recommendation (appropriate 1:1 ratio balloon pre-dilatation with a semicompliant balloon at nominal atmosphere; post-dilatation at high pressure [1:1 ratio] with a noncompliant balloon). No intravascular imaging was performed before stent implantation, thus angiographic images were used by the operator to select the device size. Figure 1 shows the baseline RCA stenosis and the angiography result after PCI. Notably, intravascular optical coherence tomography (OCT) was performed at the end of the procedure in order to assess the results of stent implantation; OCT images showed a good stent expansion and a small area of stent malapposition at the proximal part of the stent (figs 2 and 3).

After 8 months the patient was re-admitted because of unstable angina. The coronary angiograms showed a severe focal restenosis of the RMS previously implanted in the RCA. However, coronary intravascular ultrasound (IVUS) did not show any significant intraluminal proliferation, but rather demonstrated an impressive late stent recoil (fig. 4; video 1). After quantitative coronary analysis, relative late stent recoil was estimated to be 54%. The patient was retreated with PCI: pre-dilatation with 3.0 × 20 mm semi-compliant balloon; subsequent implantation of a 3.0 ×

Figure 1: (A) The angiogram shows right coronary artery proximal narrow stenosis. (B) Result after percutaneous coronary intervention (PCI) with implantation of a drug-eluting resorbable magnesium stent;



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23 mm everolimus drug-eluting stent; multiple post-dilatations with 3.5 × 15 mm noncompliant balloon. No major adverse events were observed after the procedure and the patient was discharged 2 days afterwards.

You will find the video file in the multimedia collection of *Cardiovascular Medicine*: https://cardiovascmed.ch/online-only-content.

Discussion

Bioresorbable scaffold stents (BRSs) were developed as an alternative to drug-eluting stents (DESs), with the hope of reducing the rate of late and very late stent thrombosis, such as the accelerated in-stent formation of neo-atherosclerosis. However, the first generation of BRSs with poly-L-lactil acid (PLLA) failed to achieve this aim. Indeed, despite high procedural success rates and favourable early outcomes, recent large-scale randomised controlled trials showed an increased rate of early and late device thrombosis when first-generation BRSs were compared with second-generation DESs [1, 2]

The magnesium-based Magmaris BRS (Biotronik AG, Bülach, Switzerland), which received a CE mark in 2016, has shown promising results in phase III trials [3, 4]. Moreover, the magnesium-based BRS might be able to overcome some of the disadvantages of first-generation BRSs by providing a higher radial force, smaller footprint and lower strut thickness, as well as faster resorption [5, 6]

Figure 2: Intravascular optical coherence tomography image after PCI, showing the good result of stent implantation with complete expansion at the point of minimum luminal diameter.

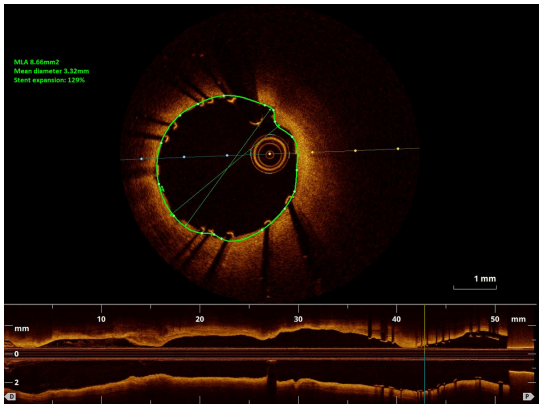


Figure 3: Intravascular optical coherence tomography image after PCI, showing a small area of malapposed stent struts in the proximal part of the stent.

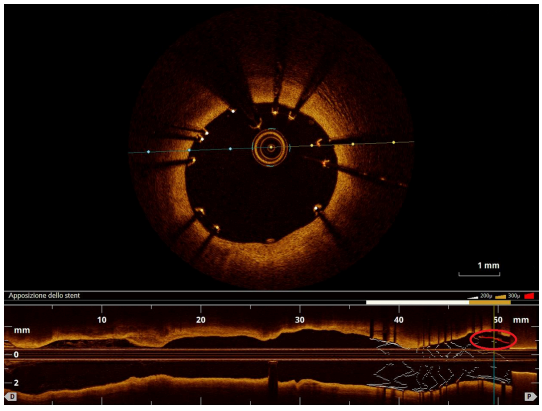
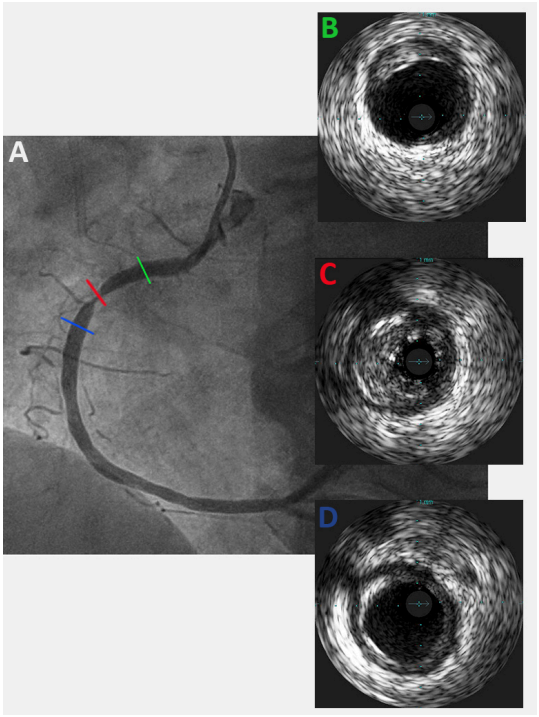


Figure 4: (A) Eight-month right coronary artery angiogram. (B) Cross-sectional intravascular ultrasound image (IVUS) at the level of the green line. (C) Cross-sectional IVUS at the level of the red line, showing the late stent recoil in the absence of neo-intimal proliferation. (D) cross-sectional IVUS at the level of the blue line.



Compared with metallic stents, all bioresorbable scaffolds have different mechanical properties, including higher flexibility and lower radial strength. The phenomenon of late stent recoil is the result of the balance between the elastic recoil and radial strength of the stent. Previous studies revealed that the plaque characteristics of stented segments could also affected this phenomenon [7].

Tanimoto et al. demonstrated that bioresorbable everolimus-eluting stent (BVS) shrank in size during the follow up period [8]. Indeed, the authors reported an absolute late stent recoil of 0.65 ± 1.71 mm^2, with the percentage late stent recoil ranging from 7.60 to 23.3%, which is higher than that observed with second-generation DESs [9].

This phenomenon could be related to the higher flexibility of BVSs in comparison with metal stents. In addition, because the BVS is gradually metabolised, the polymer backbone loses its structural integrity over time, which could diminish its radial strength and lead the stent to shrink.

Recently Barkholt and colleagues compared mechanical properties of a magnesium-based BRS with other polymeric scaffolds and permanent metallic DESs. Recoil 120 minutes after deployment was the greatest for the magnesium-based BRS; however after appropriate post-dilatation with a noncompliant balloon all devices had similar diameters [10]. This underlines the importance of post-dilatation after implantation of a magnesium-based BRS, as already shown by Blachutzik [11].

In conclusion, we report a case of unexpected late stent recoil after RMS implantation, in which different imaging modalities were used at the time of the procedure and at follow up. Although this represents a debatable issue, the combination of OCT and IVUS demonstrated a late collapse in a resorbable magnesium scaffold causing a severe stenosis.

Disclosure statement
No financial support and no other potential conflict of interest relevant to this article was reported.

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