A 50-year-old man with a history of smoking and hyperlipidemia, but no chest pain, was admitted because of an abnormal electrocardiogram and regional wall motion abnormality on echocardiography (mild inferior hypokinesis). Coronary angiography revealed 2 chronic total occlusions (CTOs): ostial right coronary artery (RCA) and mid left circumflex artery. The long RCA CTO lesion was treated by
intentional, retrograde creation of a subintimal lumen with a “knuckled” Fielder XT wire (Asahi Intecc, Nagoya, Japan) (Fig. 1) followed by deliberate implantation of 4 overlapping paclitaxel-eluting stents into the subintimal space. Complete stent-vessel wall apposition and overlapping of adjacent stents was confirmed by post-procedural intravascular ultrasound (Figs. 2 and 3). The 8-month follow-up coronary angiogram showed multiple aneurysms in the RCA, but not in the mid left circumflex artery that had been treated using a conventional antegrade CTO approach and single stent implantation into the true lumen. At the sites of the RCA aneurysms, intravascular ultrasound demonstrated large areas of late acquired stent malapposition (LSM) due to vessel remodeling (an increase in cross-sectional and longitudinal vessel dimensions), changes that were most marked at the sites of subintimal stent implantation (Fig. 2). These areas of LSM were accompanied by stent fractures as well as a newly formed gap between the (previously overlapped) most distal stent and the proximal adjacent partial stent segment (Fig. 3). Serial intravascular ultrasound quantitative analysis revealed positive remodeling (increase in mean vessel area from 15.0 to 20.8 mm²). The newly formed gap between previously overlapped stents suggested that positive vessel remodeling occurred in the longitudinal direction as well as cross-sectionally.

Drug-eluting stents reduce restenosis even after treatment of CTO lesions. However, the frequency of LSM appears to be greater after the implantation of drug-eluting stents versus bare metal stents and especially in the setting of treatment of CTO lesions; Hong et al. (1) reported that predictors of LSM were total stent length, primary stenting in acute myocardial infarction, and stenting of CTO lesions. Hong et al. (1,2) found that LSM may be associated with less neointimal hyperplasia, but it

Figure 2. Cross-Sectional Positive Remodeling

The index and follow-up angiograms (left) after 4 overlapping paclitaxel-eluting stents (2.75 × 32 mm, 3.0 × 32 mm, 3.0 × 32 mm, and 3.5 × 28 mm) were implanted from the distal bifurcation to orifice of the RCA to treat a long CTO lesion. The dashed line indicates the subintimal stents; the 4 double-headed white arrows indicate the location of each of the 4 stents. The follow-up angiogram demonstrated multiple aneurysms especially in the proximal segment where a large dissection was observed at the index procedure. Cross-sectional and longitudinal IVUS panels (A) correspond to A on the baseline angiogram; cross-sectional and longitudinal IVUS panels (A’) correspond to A’ on the follow-up angiogram. The baseline and follow-up cross-sectional IVUS images are from the same anatomic location(s) in the RCA; note the small right ventricular branch at the 1-to-2-o’clock position on the baseline and follow-up images that corresponds to the same small right ventricular branch on the angiograms. At baseline, both the cross-sectional and longitudinal IVUS images (A) showed well-apposed and well-expanded stents. At follow-up (A’), there were large areas of late acquired stent malapposition (LSM) due to positive vessel remodeling (white arrowheads) on both the cross-sectional and longitudinal IVUS images. Abbreviations as in Figure 1.
has also been implicated in patients with very late stent thrombosis (3). In the current case, large areas of LSM were observed at the sites of angiographic aneurysms that were detected 8 months after treatment of an RCA CTO. The complex procedure included deliberate subintimal passage of the guidewire and implantation of drug-eluting stent into the subintimal space. This technique might have exaggerated injury to the medial and adventitial layers; or the adventitial location of the drug and polymer may have induced a local hypersensitivity to cause cross-sectional and longitudinal vessel remodeling, LSM, and aneurysm formation. Of note, there were no areas of aneurysm formation or LSM 16 months after treatment of the left circumflex artery CTO using a conventional antegrade approach with sirolimus-eluting stent implantation into the true lumen.

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REFERENCES