Detailed *in vivo* visualization of stent fracture causing focal restenosis using 3D reconstruction software for high-resolution optical coherence tomography images

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A 55-year-old female underwent repeat coronary angiography for recurrent angina, 9 months after percutaneous coronary intervention (PCI) of a mid-right coronary artery (RCA) chronic total occlusion with implantation of two overlapping Orsiro™ sirolimus-eluting stents (3.0 × 30 mm at 20 atm; 2.5 × 30 mm at 16 atm) (see Supplementary data online, Video S1). The distal part of the stented segment showed a focal in-stent restenosis (ISR) with the abnormal motion pattern (see Supplementary data online, Video S2). Optical coherence tomography (OCT) with 3D reconstruction confirmed suspected stent fracture (Panels A – G; see Supplementary data online, Videos S3 and S4).

Stent fracture is rare, but may lead to ISR or stent thrombosis. Stents with closed cell design and thick struts are less flexible and more prone to fracture. The Orsiro™ stent is a newly designed cobalt chromium stent with ultrathin struts (60 μm). The impact of this design on the incidence of stent fracture remains unclear. Saphenous vein graft and RCA location, stent under- or overexpansion, long-stented segments, overlapping stents, tortuous vessels and repetitive kinking caused by vessel movement are predictors of stent fracture.

Angiography revealed a completely straightened stented vessel segment after initial PCI. After stent fracture, vessel motion appeared comparable with that observed before initial PCI (see Supplementary data online, Video S2 and S5). An increase in flexion forces after vessel straightening was probably the predominant cause of stent fracture in this case. Uneven struts distribution and isolated unopposed luminal struts with no connection or overriding contiguous struts suggest stent fracture in a conventional OCT pullback. High-quality 3D OCT reconstruction, acquired off-line using the dedicated software unavailable in current OCT systems, had an important added value over 2D OCT imaging in this case.

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OCT of the RCA 9 months after stent implantation: at the distal stent edge, normal stent expansion is seen (A); cross-sections 5 mm more proximally show outward vessel wall bulging, compatible with coronary ectasia (B); distal to the site of minimal lumen area (MLA), uneven distribution of stent struts with void of struts from 10 to 2 o’clock is noted (C); whereas at the site of MLA, neointimal hyperplasia is visible (D). 3D reconstruction of the pullback (E, F) and the stent (G) using the dedicated software for segmentation of different structures in cross-sectional OCT images: the disruption of stent integrity corresponds with the void of struts in (C), confirming the stent fracture (blue arrows).

Supplementary data are available at European Heart Journal – Cardiovascular Imaging online.