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Pathology of severe coronary artery calcification treated with orbital atherectomy followed by balloon modification

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A 66-year-old-man with interstitial pneumonia and diabetes presented with effort angina. Coronary angiography findings showed severe stenosis of the left anterior descending artery (LAD). Percutaneous coronary intervention was performed, and intravascular ultrasound (IVUS) imaging findings demonstrated a >270° calcification at the narrowest lesion. Three runs of low-speed retrograde orbital atherectomy (OA) were performed in the middle portion of the LAD with circumferential calcification. We used a 2.5-mm cutting

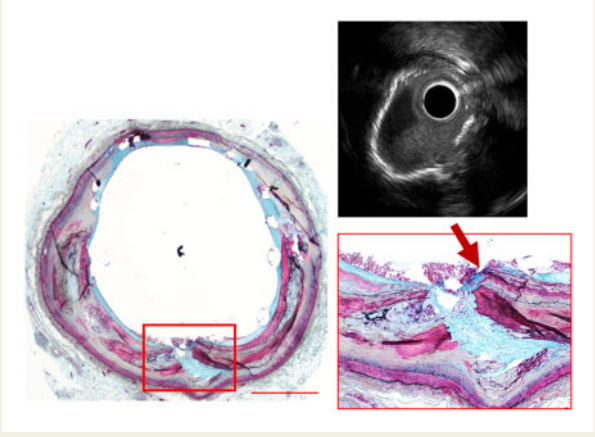

Figure 1 Histological section with Movat Pentachrome stain of the cracked calcification-plate with well apposed struts at the distal site of the culprit. Low-power image demonstrates a severely calcified coronary artery with well apposed stent struts. High-power image of the red boxed area shows crack of calcification because of orbital atherectomy and balloon inflation (pointed by red arrow). The right upper image shows the same cross-sectional intravascular ultrasound image post lesion modification; orbital atherectomy followed by balloon modification.

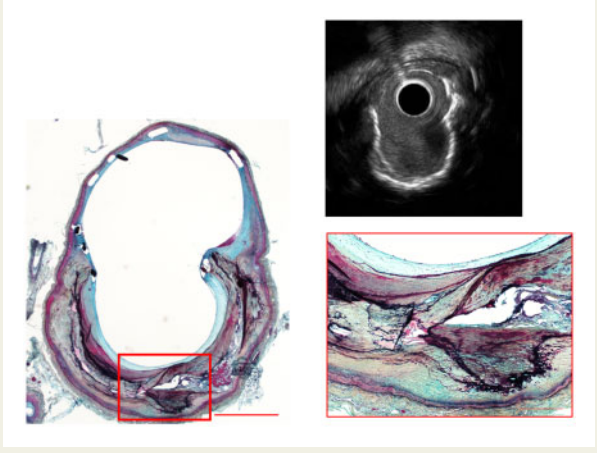

Figure 2 Histological section of snowman-like coronary artery dilation with stent malapposition. Low-power image demonstrates a severely calcified coronary artery with malapposed stent struts. High-power image of the red-boxed area shows no signs of a crack in the sheet calcification. The right upper image shows the same cross-sectional intravascular ultrasound image post lesion modification; orbital atherectomy followed by balloon modification.

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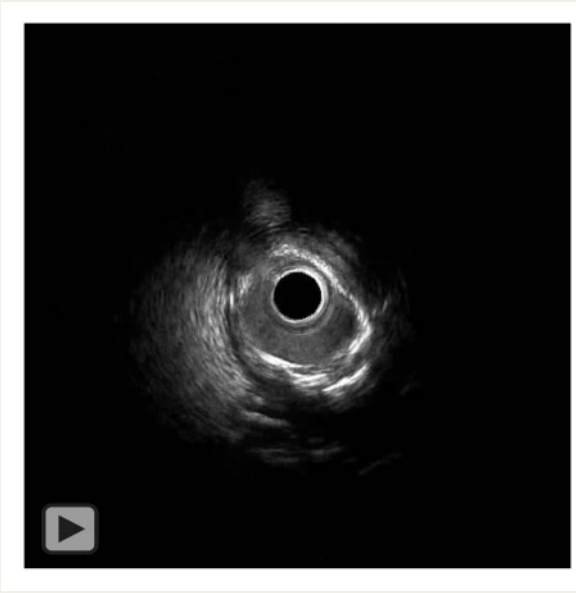
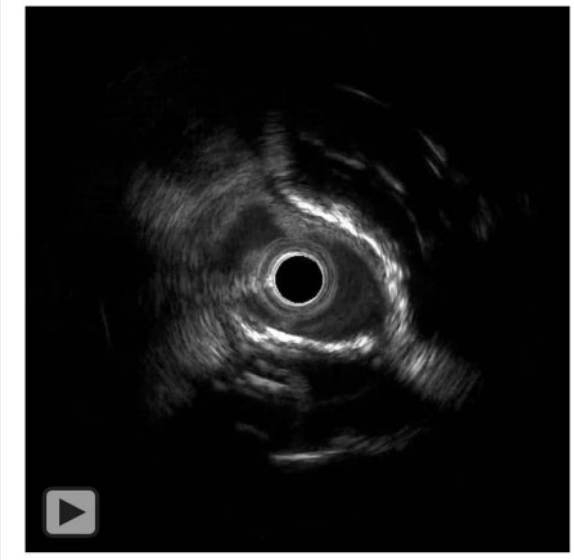


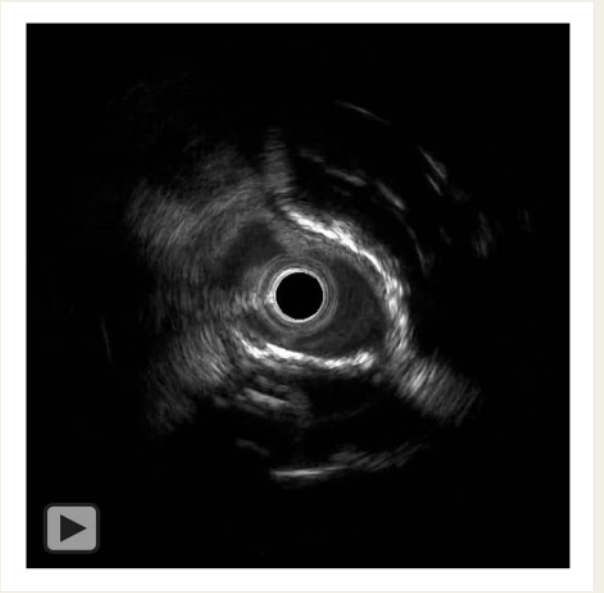
Video 1 Intravascular ultrasound before intervention.



Video 2 Intravascular ultrasound after orbital atherectomy and cutting balloon inflation.

balloon, followed by a 3-mm scoring balloon to dilate the lesion; both balloons were inflated at rated burst pressure; subsequently, a 3.5-mm newer-generation sirolimus-eluting stent was implanted. The final IVUS imaging examination performed after stent implantation showed snowman-like dilation with stent malapposition in the middle portion of the lesion. After 4 months, the patient died of pulmonary hypertension.

Pathological sections of the stented lesion showed an underlining sheet of calcium that was >1 mm thick with a circumferential distribution of >270°. The calcified lesion, in which OA was performed, was fragmented without ablation signs on its surface. The fragmented part



Video 3 Intravascular ultrasound after stent implantation.

was completely separated into two pieces, resulting in good apposition (*Figure 1*). At the remaining malapposed strut in the snowman-like dilated site, a 270° sheet calcification showed recoil without the calcium cracking (*Figure 2*). To the best of our knowledge, this is the first case report showing co-registered images of IVUS and histological sections, which demonstrate how OA works in severely calcified lesions. The histopathological examinations revealed calcification that was >1 mm thick circumferentially, suggesting that plain old balloon angioplasty alone and cutting balloons, cannot crack such lesions, as shown in a previous optical coherence tomography study.[1] In this case, the crown rotated and 'knocked' the plate-like calcification discontinuously, thereby breaking the thick calcification without a medial tear, which avoided restenosis.[2]

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

Ethical approval: The study was conducted in accordance with the Helsinki Declaration.

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: S.T. receives research grants from Abbot Vascular Japan, Boston Scientific Japan, Medtronic, and receives honoraria from Boston Scientific Japan. G.N. is a consultant for Boston Scientific, Abbott Vascular, Terumo Corp., Japan Medical Device Technology Co., Ltd, ZAIKEN, and receives research grants from Boston Scientific, Abbott Vascular, Terumo Corp., Japan Medical Device Technology Co., Ltd. Other authors have declared no conflict of interest.

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