Protruding In-Stent Mass After Bioresorbable Polymer Sirolimus-Eluting Stent
— Ex Vivo Intravascular Imaging and Histopathology —

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A 70-year-old man was hospitalized due to polymyositis and died of pneumonia 1 week after admission. Sirolimus-eluting bioresorbable polymer coated stent (Ultimaster; Terumo, Tokyo, Japan) had been implanted in the circumflex artery 2 months previously. He had been prescribed aspirin 100 mg/day and clopidogrel 75 mg/day. An autopsy was performed followed by ex vivo intravascular ultrasound (IVUS; Terumo), optical frequency domain imaging (OFDI; Terumo) and coronary angiography (CAS; FiberTech, Tokyo, Japan). IVUS and OFDI showed a convex-shaped mass with echo attenuation, and protruding mass with a smooth surface accompanied by high backscattering within the stent-implanted segment, respectively (Figure 1A, B; Movie S1). CAS showed a yellowish polypoid lesion with red thrombus adhesion was observed on CAS (arrows). Arrowhead, nylon suture for the landmark of tissue preparation.

After perfusion fixation of the heart under the normal diastolic pressure by 10% buffered formalin for 24 h, epicardial coronary arteries were removed from the heart. The whole stent segment was embedded in plastic (Technovit 8100; Heraeus Kulzer, Wehrheim, Germany) with the stent struts. Histological sections stained by hematoxylin-eosin and Masson's trichrome showed a convex mass lesion (Figure 2A) composed of cholesterol crystals, macrophage foam cells and necrotic debris over the stent struts (Figure 2B). Although we could not confirm the endothelial cell coverage due to the technical difficulties of immunohistochemistry using the plastic embedded sections, the luminal surface of the mass was partially covered with thin and flat cells, consistent with endothelial cells. Part of the luminal surface, however, lacked the cell coverage with fibrin (Figure 1C).
thrombus adhesion (Figure 2C). We speculated that the mass lesion over the stent struts may have been derived from (1) protrusion of native necrotic core after stent implantation; or (2) a lipid-rich de novo lesion after stent implantation. On histology the mass lesion was continuous with the underlying native necrotic core (Figure 2D). On additional deep sectioning, the stent struts were seen to penetrate into the underlying necrotic core (Figure 2E,F). Furthermore, the size of the cholesterol clefts was similar to that of native underlying plaque. Previous studies suggest that cholesterol clefts, as one of the tissue components of neoatherosclerosis, are fragmented and smaller in size compared with those identified in the native plaque.\(^1\)\(^\text{,2}\) These findings support the former hypothesis of protrusion of native necrotic core toward the lumen, followed by superficial adhesion of fibrin thrombus. We could not, however, completely exclude the latter hypothesis of de novo neoatherosclerosis formation within the stent implanted segments.

Intravascular imaging, namely optical coherence tomography and CAS, could detect the various lesions including thrombus and neoatherosclerosis after drug-eluting stent (DES) implantation.\(^3\) The advantage of these imaging devices is essential and they play an important role in the present percutaneous coronary intervention era.\(^4\) The diagnostic accuracy of these devices, however, particularly with regard to positive predictive value, is relatively low, as had been expected according to pathological validation study.\(^5\)\(^\text{,6}\) Although imaging was carried out within 6h of death before tissue fixation with formalin, we understand the limitation of reproducibility of intravascular imaging in ex vivo imaging of autopsy cases. Tissue components may dramatically change after death, particularly soluble cell components. In addition, hemodynamics affect the physiology and morphology of cardiovascular tissue. These factors may affect ex vivo imaging.

The pathology of DES-implanted coronary arteries does not elucidate the whole picture.\(^7\) We discovered that the protruding in-stent mass was composed of cholesterol clefts and necrotic debris. Such lesions may require dual anti-platelet therapy due to the high thrombogenic activity derived from the endothelial cell defect. It is important to accumulate autopsy cases after DES deployment in order to collect pathological evidence of tissue reaction against these devices, given the millions of DES implanted in our patients.

Disclosures / Information on Grants

None.

References


Supplementary Files

Supplementary File 1

Movie S1. Optical frequency domain imaging of in-stent mass.

Please find supplementary file(s); http://dx.doi.org/10.1253/circj.CJ-17-0263