Diversity of Lesion Morphology in CTEPH Analyzed by OCT, Pressure Wire, and Angiography

Percutaneous transluminal pulmonary angioplasty (PTPA), or balloon pulmonary angioplasty, has been the focus of much attention and has rapidly been established as a promising new therapy for chronic thromboembolic pulmonary hypertension (CTEPH) in recent years (1,2). The procedures have been modified by the use of several modalities such as intravascular ultrasound and pressure wire (3). Here, we further present the potential utility of optical coherence tomography (OCT) in the PTPA procedure. In addition, we demonstrate the diversity of lesion morphology in CTEPH analyzed by these modalities.

Lesion type A in Figure 1 is a representative pulmonary arterial lesion that is easily identified by angiography. Before PTPA, OCT revealed a tight stenosis due to a lipid-rich plaque with possible organized thrombus in this lesion. The lesion was dilated by PTPA, and OCT after PTPA demonstrated eccentrically located organized thrombus accompanied by incomplete improvement of pressure ratio (<0.8), the ratio of distal pressure to proximal pressure across the lesion (shown as fractional flow reserve [FFR] in Figure 1) detected by pressure wire, demonstrating that this lesion cannot be easily dilated.

**FIGURE 1** Angiography, OCT, and Pressure Ratio in Chronic Thromboembolic Pulmonary Hypertension

Fractional flow reserve (FFR) represents the ratio of the distal pressure to proximal pressure across the lesion. Blue arrows mean the performance of percutaneous transluminal pulmonary angioplasty (PTPA). OCT = optical coherence tomography; Pa = mean pressure in the proximal area of the target lesion detected by pressure wire; Pd = mean pressure in the distal area of the target lesion detected by pressure wire.
dilated by PTPA. Meanwhile, lesion type B is moderately difficult to identify by angiography, and OCT revealed a honeycomb-like structure. Lesion type C is a representative lesion that is difficult to identify by angiography. OCT revealed a lotus root-like structure in the pulmonary artery in this lesion before PTPA, and impaired flow was confirmed by pressure ratio. Blood flow could pass through some of the spaces in the lotus root-like structure, but each of these flow spaces was significantly narrowed, which may explain why this lesion was difficult to identify by angiography and had a significantly reduced pressure ratio. OCT after PTPA demonstrated that the lotus root-like structure was destroyed by balloon dilation and crushed toward the vessel wall, accompanied by significant improvement of pressure ratio (>0.8), demonstrating that the lesions with lotus root-like structures can be easily dilated by PTPA. Lesion type D, located within a pulmonary artery that has unimpaired blood flow and with a pressure ratio that was detected by pressure wire, was also within the normal range. However, OCT demonstrated a lotus root-like structure within this vessel, with possible organized thrombus adherence to the vessel wall. The main space through which blood flow passed was not significantly narrowed, which may explain why this vessel had a lotus root-like structure but no impaired flow. Interestingly, OCT in lesion type D demonstrated that normal angiographic findings and a preserved value of pressure ratio do not necessarily ensure normal structure of vessels in CTEPH. These findings suggested that the lotus root-like structure could be seen in 2 cases (i.e., lesions with or without impaired flow) but both are difficult to identify by angiography.

PTPA has recently been developed and needs further improvement. The findings in this report suggest that OCT is a useful tool to demonstrate the morphological features of lesions. In particular, OCT is useful to detect target lesions that are difficult to identify by angiography. A combined approach, using angiography as a subjective tool to evaluate flow grade, a pressure wire to provide an objective value of flow impairment, and OCT as a useful tool to demonstrate the concrete morphological features of a lesion, may enable more appropriate judgment regarding the PTPA strategy.

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REFERENCES

Coexistence of Degenerative Aortic Stenosis and Wild-Type Transthyretin-Related Cardiac Amyloidosis

Degenerative aortic stenosis (AS) is a growing cause of heart failure and death in the elderly. The majority of patients with symptomatic AS are currently treated with surgical or transcatheter aortic valve replacement (TAVR). It was recently suggested (1) that a share of the sometimes lethal complications arising during and after aortic valve replacement are to be attributed to coexistent cardiac amyloidosis. In an autopsy series of patients who had undergone TAVR, Nietlispach et al. (2) found varying degrees of ventricular myocardium amyloid infiltration in approximately one-third of cases. The etiology of amyloidosis was not defined, but considering patient age and clinical profile, it is plausible that these patients had wild-type transthyretin...