In this issue of the Journal, a clinical investigation by Ozaki et al focuses on the flushing solution used for image acquisition with frequency-domain optical coherence tomography (FD-OCT). The authors present the cross-sectional area measurement as a quantitative evaluation using low-molecular dextran L (LMD-L) approximate to that of contrast media, and the non-inferiority of LMD-L to contrast media with regard to FD-OCT image quality.

Although the cross-sectional and longitudinal images of OCT are analogous with those of intravascular ultrasound (IVUS), the image resolution of OCT is extremely high (=10–20 μm), which is more than 10-fold that of IVUS. Therefore, this imaging modality is suitable for observation of the detailed features and microstructure of the vessel lumen. In addition, OCT enables validation of the tissue components of the vessel wall with high accuracy. Using OCT, quantitative measurement of length or area, identification of thin neointimal growth after drug-eluting stent implantation, and in vivo histopathologic diagnosis of atherosclerotic plaque and intracoronary thrombus can be achieved. Of great importance is that residual red blood cells prominently attenuate the backward OCT signals and interfere with intravascular imaging, so efficient blood removal and replacement with transparent liquid are essential to maximize the advantage of the optical system.

At present, the new-generation OCT system (ie, FD-OCT; imaging catheter: Dragonfly™, LightLab Imaging Inc, Westford, MA, USA) is available for clinical use in Japan. Conventional time-domain OCT usually requires not only an imaging catheter (ImageWire™, LightLab Imaging Inc) but also a special balloon catheter (Helios™, LightLab Imaging Inc) for coronary occlusion at the proximal segment adjacent to the target lesion. Lactated Ringer’s solution is continuously injected through the occlusion catheter in order to wash out the blood. The technological innovation in FD-OCT, namely acceleration of the image processing rate and pullback speed, enables observation of the lumen in a moment. FD-OCT also dispenses with the occlusion catheter, and flushing via a guide catheter far from the target lesion assists image acquisition. The change in flushing method prevents transmural myocardial ischemia induced by coronary occlusion and helps to decrease procedural complications during OCT imaging.

For effective blood removal from the visual field, contrast media with high viscosity is now for FD-OCT imaging. In the Western countries, contrast media is commonly infused into the coronary artery for FD-OCT imaging.

In this report, the qualitative and quantitative analyses of FD-OCT images were compared between contrast media and LMD-L. No significant differences were found between the 2 solutions, and the non-inferiority of LMD-L to contrast media was verified. Direct comparison of the use of different solutions was performed in the same patient for the same segment, and at the same flushing rate. That is very important, because numerous factors (eg, coronary anatomy, hemodynamics, blood viscosity, resistance of myocardial capillaries) influence the flushing conditions and subsequent image quality of FD-OCT. As in the current protocol, only identical conditions except for the flushing solution permits a clear comparison.

Contrast-induced acute kidney injury or nephropathy (CIN) will occur in 2–25% of patients undergoing a percutaneous coronary intervention, and is closely associated with poor short- and long-term outcomes, such as death resulting primarily from cardiovascular events. Thus, prevention of CIN is a key issue for interventional cardiologists. Several trials have shown the effectiveness of antioxidants, such as N-acetylcysteine, ascorbic acid, and sodium bicarbonate hydration. Meta-analyses, however, have confirmed the heterogeneity of the results of these trials, and their efficacy has not always been established. Therefore, the simplest and most certain way to reduce the incidence of CIN is decreasing the total amount of contrast media. In the present study, for the observation of 1.1 stent segments, 16.8±1.7 ml of contrast media per patient was injected. Although patients with almost normal renal function were selected for this research, the dose of contrast media may be clinically significant in cases of renal impairment. For the moment, we have to wait for evidence based on a randomized comparison between 2 separate groups: use of contrast media alone and LMD-L alone. However, the decrease in the amount of contrast media surely promises the benefits of protecting renal function as well as medical economy.

Using LMD-L for FD-OCT imaging is still a method that is particular to Japan, because this solution has been unavailable in many other countries. This less invasive and beneficial method has the potential to become the future world standard.

References


