What Is the Optimal Time to Estimate the Final Vascular Response to a Drug-Eluting Stent by Optimal Coherence Tomography?

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Drug-eluting stents (DES) have significantly reduced the incidence of restenosis and the need of repeat revascularization after percutaneous coronary intervention (PCI). Each DES has 3 components, comprising stent strut, polymer and drug. Drugs can be coated on the stent strut and released slowly to suppress cell proliferation over a long duration by virtue of the polymer. However, it is now known that remaining polymer can delay the vascular healing process such as endothelialization by inflammation and localized hypersensitivity, a process that may induce very-late stent thrombosis. Therefore, accurate evaluation of the neointimal coverage of DES is very important in anticipating the prognosis of PCI. Optical coherence tomography (OCT) is an intravascular imaging modality that uses near-infrared light to generate cross-sectional arterial images, giving in vivo images of the coronary arteries and stented segments with up to 10–15 μm of spatial resolution. Therefore, OCT enables precise measurement during PCI of the diameter and length of the diseased artery, side branch stenosis and stent edge dissection after stent implantation. Furthermore, OCT has a very high sensitivity for detecting a small degree of restenosis, stent malapposition and uncovered stent struts after DES implantation. It can also detect precisely the characteristics of neointimal hyperplasia and the amount of neointimal hyperplasia.

In this issue of the Journal, Kubo et al. present their work on the vascular response to DES with biodegradable vs. durable polymer. According to their findings, 980 frames with 8,996 struts in everolimus-eluting stents (EES) from 55 EES-treated lesions in 48 patients and 9,745 struts in biolimus-eluting stents (BES) from 51 BES-treated lesions in 43 patients were analyzed. More than 90% of struts in both EES and BES were covered by neointima. However, mean neointimal thickness in EES and BES patients was 105±82 μm and 91±80 μm, respectively (P<0.001) and the percentage of uncovered struts (34.7% vs. 9±10%, P<0.001) and the frequency of stent-treated lesions with any uncovered struts (n=28, 51% vs. n=42, 82%, P=0.001) were statistically lower in EES compared with BES. And the percentage of malapposed struts (0.2±0.8% vs. 1.3±2.8%, P=0.006) and the frequency of stent-treated lesion with any malapposed struts (n=6, 11% vs. n=14, 27%, P=0.028) were meaningfully lower in EES compared with BES. Therefore, the vascular healing process is more favorable with EES than with BES.

However, unmet questions remain. First, there was no initial imaging by OCT just after DES implantation, so the authors could not exclude a difference in stent malapposition at the index PCI. Second, the vascular healing process is progressive in the case of BES. Therefore, the possibility of a difference in the period of vascular healing according to the type of DES remains. Third, although OCT offers higher resolution imaging than any other imaging modality, it does not have a sufficient resolution to detect endothelialization forming a 5-μm thick cellular monolayer. Fourth, despite much OCT data being published, there are few reports that link OCT data with clinical outcomes.

Not withstanding these limitations, the present report supports the results that EES are superior to BES in terms of 1-year definite stent thrombosis. Unmet problems remain: How does the vascular healing process with BES progress over time? How do we decide the duration of dual antiplatelet therapy according to the type of DES? In the future, both of these critical points should be investigated.

References
