Oversized post-dilatation of current bioresorbable vascular scaffolds: kill or cure?

Clemens von Birgelen1,2*, MD, PhD; Mounir W.Z. Basalus1, MD, PhD 1. Department of Cardiology, Thoraxcentrum Twente, Medisch Spectrum Twente, Enschede, The Netherlands; 2. Health Technology and Services Research, MIRA - Institute for Biomedical Technology and Technical Medicine, University of Twente, Enschede, The Netherlands


While the significance of this finding is still unclear, the timing of scaffold thrombosis, early after implantation, suggests a relation with the relatively thick strut dimensions, the apposition to the vessel wall, and/or implantation techniques (e.g., aggressiveness of lesion preparation, adequate device sizing with or without intracoronary imaging, employment of post-dilatation, balloon size and pressures used). For thick-strut coronary stents and scaffolds alike, it is of paramount importance to appose the device well to the vessel wall.


Severely oversized post-dilatations of metallic stents are generally well tolerated without destructive consequences to the metal frame, but may have a significant effect on stent geometry. Basalus MW, van Houwelingen KG, Ankone MJ, Feijen J, von Birgelen C. Micro-computed tomographic assessment following extremely oversized partial postdilatation of drug-eluting stents. EuroIntervention. 2010;6:141-8.

The consequences of BVS overexpansion have not been fully examined, so it was high time that a thorough evaluation of this matter was performed and published. In the current issue of EuroIntervention, Foin et al report the results of meticulous bench-top experiments on the overexpansion of BVS with non-compliant balloons of increasing diameters. Foin N, Lee R, Mattesini A, Caiazzo G, Fabris E, Kilic D, Chan JN, Huang Y, Venkatraman SS, Di Mario C, Wong P, Nef H. Bioabsorbable vascular scaffold overexpansion: insights from in vitro post-expansion experiments. EuroIntervention. 2016;11:1389-99.

While BVS of different sizes could be oversized by 1 mm in a non-constrained setting, only overexpansion with a non-compliant balloon 0.5 mm larger than the BVS size was feasible in a constraining eccentric arterial lesion model. Excessive overexpansion of BVS beyond that limit resulted in scaffold fractures and a decrease in mechanical support, as impressively demonstrated by mechanical point force measurements. This loss of mechanical support may trigger adverse clinical events. The work of Foin et al confirms the “no more than 0.5 mm larger” instruction for BVS post-dilatation with non-compliant balloons which was provided by the device manufacturer. In addition, interesting insights with 2D and 3D optical coherence tomography (OCT) in fractured BVS samples demonstrated an advantage of 3D OCT in detecting fracture sites. Partial overexpansion of BVS with non-compliant balloons beyond the safety limit of 0.5 mm resulted in fractures which were located, in particular, in the region between the post-dilated and non-post-dilated segments.
Shaw E, Figtree GA, Hansen PS, Bhindi R. Clinical utility of optical coherence tomography (OCT) in the optimisation of Absorb bioresorbable vascular scaffold deployment during percutaneous coronary intervention. EuroIntervention. 2015;10:1154-9. Does the current study provide answers to all relevant questions about the overexpansion of bioresorbable scaffolds? Well, probably not. While the authors obtained highly valuable data about Absorb BVS, they did not study other polymer- or magnesium-based bioresorbable scaffolds which have different physical properties.

Ormiston J, Webber B, Ubod B, Darremont O, Webster MW. An independent bench comparison of two bioresorbable drug-eluting coronary scaffolds (Absorb and DESolve) with a durable metallic drug-eluting stent (ML8/Xpedition). EuroIntervention. 2015;11:60-7. For instance, a PLLA-based scaffold, which regains its diameter after acute recoil due to the “self-correcting” properties of the device, was previously shown to have a much greater tolerance to significantly oversized post-dilations than the Absorb BVS.

Ormiston J, Webber B, Ubod B, Darremont O, Webster MW. An independent bench comparison of two bioresorbable drug-eluting coronary scaffolds (Absorb and DESolve) with a durable metallic drug-eluting stent (ML8/Xpedition). EuroIntervention. 2015;11:60-7. Finally, Foin et al used expired BVS for their experiments, and polymer ageing could have affected the physical properties of the devices tested.

Bergström JS, Hayman D. An Overview of Mechanical Properties and Material Modeling of Polylactide (PLA) for Medical Applications. Ann Biomed Eng. 2015 Sep 14. [Epub ahead of print]. Therefore, it would be of great interest to perform additional in vitro studies with fresh samples of the Absorb BVS and other bioresorbable scaffolds, using the same experimental set-up as applied in the current study. To conclude, well-controlled post-dilatation and overexpansion of current BVS is likely to prevent a substantial proportion of potential scaffold thromboses by improving the BVS apposition to the vessel wall. On the other hand, excessive overexpansion can lead to fractures of the polymer that may induce adverse events such as scaffold thromboses. 3D OCT, a technique which Foin et al used in their current bench-top study to identify BVS fractures, could not only help reveal the mechanisms of thrombus formation in BVS, but has – together with IVUS and other advanced quantitative coronary imaging techniques – the potential to reduce the risk of fracturing struts - See more at: http://www.pcronline.com/eurointervention/95th_issue/volume-11/number-12/259/oversized-post-dilatation-of-current-bioresorbable-vascular-scaffolds-kill-or-cure.