

Novel 'Flower-Petal' Technique for Bifurcation Stenting: Feasibility Study in Swine Coronary Arteries

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Background: Bifurcation stenting is challenging and associated with more adverse clinical outcomes compared to non-bifurcating PCI. A novel 'flower-petal' (FP) technique was devised to cover the bifurcation carina with the flared protruding end of the side branch stent. We compared FP to standard 'crush' (CR) technique in an animal model.

Methods: Sirolimus-eluting stents (SES; n=104) were implanted in 52 bifurcations of 40 pigs (4 LM; LAD/LCx, 19 LAD/diagonal, 26 LCx/marginal and 3 RCA/PDA) guided by intravascular ultrasound (IVUS) using either FP or CR with kissing balloon. Stents in main branch (MB) and side branch (SB) were assessed by QCA for minimum lumen diameter (MLD) and % diameter stenosis (%DS), post implant and at 1-mo follow-up (FU). Lumen area (LA) and minimum stent area (MSA) at the proximal, bifurcation, and distal part of the MB stent and at the ostium and distal part of the SB were assessed by IVUS. Hearts were harvested and perfusion-fixed 1 mo post-implant and stented vessels were embedded in plastic. Sections were cut in long-axis orientation through the bifurcation and examined for general morphology.

Results: 34 pigs (21 bifurcations with CR and 20 with FP) completed 1-mo FU; 6 pigs died prematurely, one from stent thrombosis. FP and CR both in MB and SB had similar QCA outcome. However, IVUS showed FP had higher MSA (11.5 ± 2.7 vs. 8.4 ± 2.7 mm² for CR, $P < 0.01$) and LA (8.1 ± 2.2 vs. 5.7 ± 2.4 mm², $P < 0.01$) at the bifurcation of MB and ostium of SB. Histologic sections revealed arterial wall responses to SES were similar between FP and CR, with variable neointima thickness and composition. Inspissated thrombus and amorphous material was seen in thicker neointima. Inflammation was mostly mild-to-moderate with rare intense infiltrates. Occasionally stent malapposition was seen. One CR sample had calcification at the carina. Endothelial recovery was complete or nearly so in all samples.

Conclusions: Flower-petal bifurcation stenting technique may be superior to CR by ensuring greater stent and lumen area at the bifurcation region of the MB and the ostium of the SB. Coronary arterial tissue adjacent to SES implanted in both configurations was incompletely healed one month post-implant in pigs.