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Post-stenting optimisation techniques in bifurcation percutaneous coronary interventions: much remains to be explored

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Bifurcation lesions represent a complex setting for percutaneous coronary intervention (PCI). One of the major challenges in bifurcation PCI is adapting currently available devices and techniques to the anatomy in order to restore vessel patency while preserving the fractal geometry of the bifurcation itself. Achieving this requires two main steps: (1) selection of the optimal stenting technique, according to lesion and patient characteristics, and (2) implementation of post-stenting optimisation techniques.

The stepwise layered provisional strategy is the preferred and recommended strategy for most bifurcation lesions. The use of upfront two-stent strategies is restricted to select patients with complex bifurcation lesions involving a severely diseased side branch (SB) with a large distribution territory and/or unfavourable angles[1-5].

Post-stenting optimisation techniques have been developed with the specific aim of modelling the stent platform to address malapposition in the main vessel (MV), shaping the neo-carina and preventing SB occlusion. These techniques, including the proximal optimisation technique (POT), side branch dilatation, and kissing balloon inflation (KBI), can be implemented at different moments in the procedure, can be repeated, and can be variously combined (e.g., POT-side-POT, POT-kissing-POT)[1].

The KBI technique had no experimental bench-test demonstration of its geometric effects before its implementation into clinical practice. It has recently been questioned due to the poor results of randomised trials which showed a reduction in SB restenosis with no effects on clinical outcomes. Imaging also demonstrated elliptical MV deformation and oversizing, with the risk of proximal MV restenosis or proximal edge dissection related to the inflation of aligned balloons in the proximal MV[6]. The current data do not support the routine use of KBI as a provisional strategy, although this technique can be used to address SB suboptimal results after MV crossover stenting and POT, preferably after distal SB rewiring, using non-compliant balloons with short overlaps to reduce the risk of restenosis, followed by repeat POT to reduce ellipticity in the proximal MV[7]. However, whether it is used for

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a provisional bail-out SB stenting or an upfront systematic two-stent strategy, when applying two-stent techniques, KBI is generally considered mandatory. KBI might be regarded as a measure of procedural quality, as failure to perform it is strongly associated with adverse clinical outcomes[1].

On the other hand, POT has been largely bench-tested and introduced through expert consensus based on small clinical studies and intravascular imaging data. Recently, the small randomised Proximal Optimisation Technique Versus Final Kissing Balloon Inflation in Coronary Bifurcation Lesions (PROPOT) trial failed to demonstrate the superiority of POT followed by SB dilatation over KBI in terms of strut apposition using optical coherence tomography analysis in patients undergoing provisional bifurcation PCI with zotarolimus-eluting stents, but showed optimal clinical outcomes at one-year follow-up with both techniques[8]. The results of this trial might have been influenced by suboptimal POT balloon positioning at the carina, which has been shown to be essential to avoid carina shift or stent underexpansion, and by the low rate of re-POT, which is recommended to optimise the result maintaining proximal MV circularity after SB dilatation[9].

In the current issue of EuroIntervention, Chevalier et al evaluate the impact of POT and KBI and their different combinations on clinical outcomes in real-world practice[10]. The use of POT was associated with a significant reduction in the primary composite endpoint of target lesion failure (TLF) (4.0% vs 6.0%, $p<0.01$), primarily driven by a reduction in target vessel myocardial infarction (TV-MI) (0.7% vs 2.0%, $p=0.001$), target lesion revascularisation (TLR) (1.9% vs 3.6%, $p<0.01$) and stent thrombosis (ST) (0.4% vs 1.3%, $p<0.01$). The benefit was reported as early as the first month, was sustained throughout the one-year follow-up and remained consistent in all subgroups ($p_{interaction}$=NS). Conversely, KBI had no effect on TLF (4.5% vs 4.7%, $p=0.77$), despite a significant reduction in TV-MI (1.0% vs 1.9%, $p=0.02$), which was considered related to prevention of SB occlusion rather than ST. However, an interaction between KBI and LM involvement, Medina type, stent size, and prolonged dual antiplatelet therapy (DAPT) use was noticed. The interaction analysis confirmed that POT was the protective factor for TLF, regardless of the anatomy of the bifurcation and the stenting technique, while KBI or the combination of these techniques, did not affect the primary outcome, thus suggesting that KBI should not be considered as a substitute for POT.

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The authors should be commended for performing the largest available analysis of real-world data regarding post-stenting optimisation techniques in bifurcation PCI. Their statistical analysis, using propensity score adjustments, is an elegant effort to reduce the effect of selection bias derived from the non-randomised nature of the study. However, several aspects deserve consideration. Both POT and KBI were performed in a surprisingly low percentage of patients in this registry (33.9% and 36.5%, respectively), reflecting the limited worldwide adoption of these techniques at the time of enrolment. The absence of a core lab limits the understanding of the specific anatomical features of the study population and makes it challenging to ascertain how many of these bifurcation lesions were treated using the most recent modifications to POT and KBI. Moreover, additional steps required in two-stent strategies such as refinements in bifurcation stenting techniques, as well as in POT and KBI techniques, have significantly changed practice over the study's time period and may therefore represent relevant confounders[1]. The very low rate of intravascular imaging use (9.3%) further limits the understanding of key procedural aspects such as an assessment of proper SB wiring and SB ostial scaffolding, specifically in two-stent strategies[1]. The overall event rates, including ST, were low and could partly be a consequence of the low-risk population included in this study. LM was also underrepresented in this registry (12.4%), and therefore no conclusion can be drawn regarding the role of POT and KBI in this specific setting. Finally, the use of a single stent platform limits the applicability of these findings to other devices.

Further studies, including contemporary refinements and advancements in bifurcation PCI techniques are warranted. Success in coronary bifurcation PCI likely derives from a combination of device performance, stenting technique selection and post-stenting optimisation that should be carefully tailored to individual anatomical characteristics and eventually integrated with intravascular imaging.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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