

Double-kissing single-string culotte bifurcation stenting guided by optical coherence tomography



Bernard Wong^{1*}, MBChB; Eugene Brian Wu², MD

*Corresponding author: Cardiovascular Unit, North Shore Hospital, 124 Shakespeare Road, Takapuna, Auckland, 0620, New Zealand. E-mail: bernardwong@hotmail.co.nz

This paper also includes supplementary data published online at: <https://AsiaIntervention.pconline.com/doi/10.4244/AIJ-D-25-00038>

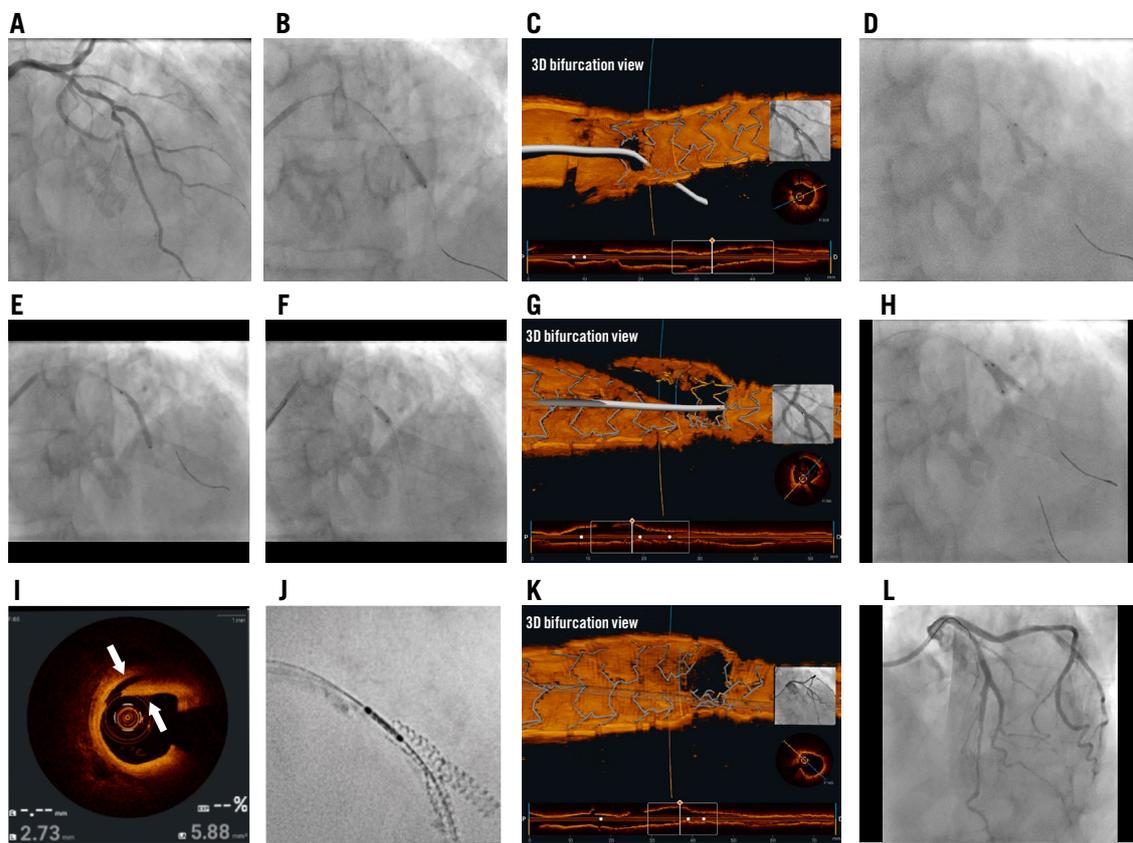


Figure 1. Step-by-step double-kissing single-string culotte assisted by 3D-OCT. A) Baseline angiography in cranial view showing severe complex bifurcation LAD/D2 disease (Medina 1,1,1). B) A 2.75x12 mm XIENCE stent deployed in the D2 with minimal protrusion into the LAD. C) 3D-OCT showing the new LAD guidewire through the first strut of the D2 stent. D) First kissing balloon inflation (KBI) with a 3.0x12 mm non-compliant (NC) balloon. E) Deployment of a 2.75x28 mm XIENCE stent in the LAD. F) Proximal optimisation technique using a 3.5x8 mm NC balloon. G) 3D-OCT showing rewiring of the D2 through the distal cell. H) Second KBI with a 3.0x12 mm NC balloon. I) Proximal edge dissection involving the media layer on OCT (white arrows). J) Coverage of the edge dissection with a 3.0x8 mm XIENCE stent as shown by stent enhancement. K) Final 3D-OCT showing a widely patent D2 ostium. L) Final angiogram showing good results of the LAD/D2 stents. Total skin radiation dose: 924 mGy; fluoroscopy time: 26.1 minutes; contrast volume: 170 mL. 3D: three-dimensional; D2: second diagonal; LAD: left anterior descending artery; OCT: optical coherence tomography

An 82-year-old male presented with exertional angina. Coronary angiography showed a severe mid-left anterior descending artery (LAD) and second diagonal (D2) bifurcation lesion (Medina 1,1,1) (**Figure 1A**). Baseline optical coherence tomography (OCT) pullbacks were performed in the LAD and D2 arteries, followed by predilatation with a 2.75 mm non-compliant (NC) balloon in both branches and a 3.0x10 mm cutting balloon in the LAD. A 2.75x12 mm XIENCE Skypoint (Abbott) drug-eluting stent (DES) was deployed in the D2, with minimal protrusion into the LAD (**Figure 1B**). Following post-dilatation with a 3.0x12 mm NC balloon, a new guidewire was looped into the D2 and carefully pulled back to rewire the LAD through the minimally protruding stent strut. OCT pullback was performed from the D2, and the three-dimensional (3D) bifurcation view confirmed the guidewire position through the first protruding strut (**Figure 1C, Moving image 1**). The first kissing balloon inflation (KBI) was performed with two 3.0x12 mm NC balloons (**Figure 1D**), and a 2.75x28 mm XIENCE Skypoint DES was deployed in the LAD (**Figure 1E**). Proximal optimisation technique (POT) was performed with a 3.5x8 mm NC balloon (**Figure 1F**). The D2 was then rewired through the distal cell, which was confirmed with OCT pullback from the LAD (**Figure 1G, Moving image 2**). A second KBI was then performed (**Figure 1H**), followed by coverage of a proximal edge dissection with a 3.0x8 mm DES and final POT (**Figure 1I, Figure 1J**). The final OCT pullback showed good stent results, including a widely open D2 ostium without excess metal at the carina (**Figure 1K, Moving image 3**). The final angiographic result is shown in **Figure 1L**.

OCT-guided percutaneous coronary intervention (PCI) in complex bifurcation lesions has been shown to reduce major adverse cardiovascular events in the Optical Coherence Tomography Optimized Bifurcation Event Reduction (OCTOBER) Trial¹. Optimising stent outcomes for OCT-guided double-kissing (DK) crush or culotte can be demanding, requiring a minimum of six OCT pullbacks per case (pre- and post- for both branches, and once after each rewiring). This may limit its use in patients with renal impairment, unless a saline flush is used for OCT assessment. Proximal versus distal stent cell rewiring is important depending on the type of bifurcation strategy used and can be confirmed by 3D-enhanced OCT. The DK single-string culotte is an attractive variation of culotte stenting that minimises stent overlap in the main vessel while ensuring coverage of the side branch ostium²⁻⁴. This technique is appropriate in bifurcation anatomies such as those described for other forms of culotte, i.e., similar main vessel and side branch sizes and a bifurcation angle <70°. Beyond anatomical considerations, operator experience in the chosen two-stent bifurcation technique is equally important to achieve optimal outcomes⁵.

The main challenge of the DK single-string culotte lies in the precise amount of protrusion of the side branch stent. If more than one strut is protruding into the main vessel,

the distal cell should be rewired before balloon dilatation to avoid an excessive metallic neocarina, converting the case into a mini-DK culotte. One strut protrusion to perform DK single-string culotte is usually only demonstrable by 3D-OCT, as in this case example. Insufficient protrusion will likely convert the case into T-stenting.

Authors' affiliations

1. North Shore Hospital, Auckland, New Zealand; 2. Prince of Wales Hospital, Chinese University of Hong Kong, Hong Kong SAR, China

Conflict of interest statement

E.B. Wu has received consulting honoraria from Abbott. B. Wong has no conflicts of interest to declare.

References

- Holm NR, Andreasen LN, Neghabat O, Laanmets P, Kumsars I, Bennett J, Olsen NT, Odenstedt J, Hoffmann P, Dens J, Chowdhary S, O'Kane P, Bilow Rasmussen SH, Heigert M, Havndrup O, Van Kuijk JP, Biscaglia S, Mogensen LJH, Henareh L, Burzotta F, H Eek C, Mylotte D, Llinas MS, Koltowski L, Knaapen P, Calic S, Witt N, Santos-Pardo I, Watkins S, Lønborg J, Kristensen AT, Jensen LO, Calais F, Cockburn J, McNeice A, Kajander OA, Heestermans T, Kische S, Eftekhari A, Spratt JC, Christiansen EH; OCTOBER Trial Group. OCT or Angiography Guidance for PCI in Complex Bifurcation Lesions. *N Engl J Med*. 2023;389:1477-87.
- Toth G, Pyxaras S, Mortier P, De Vroey F, Di Gioia G, Adjedj J, Pellicano M, Ferrara A, De Schryver T, Van Hoorebeke L, Verheghe B, Barbato E, De Bruyne B, De Beule M, Wijns W. Single String Technique for Coronary Bifurcation Stenting: Detailed Technical Evaluation and Feasibility Analysis. *JACC Cardiovasc Interv*. 2015;8:949-59.
- Toth GG, Sasi V, Franco D, Prassl AJ, Di Serafino L, Ng JCK, Szanto G, Schneller L, Ang HY, Plank G, Wijns W, Barbato E. Double-kissing culotte technique for coronary bifurcation stenting. *EuroIntervention*. 2020;16:e724-33.
- Chan YH. "Double Kissing String Culotte Technique" for bifurcation PCI: Could we make it real with modern generation of stent? Asian Pacific Society of Interventional Cardiology. 2020. <https://www.apsic.net/%E2%80%9Cdouble-kissing-string-culotte-technique-bifurcation-pci-could-we-make-it-real-modern-generation%E2%80%9D-it-really-deal> (Last accessed 15 Oct 2025).
- Park TK, Song YB, Yang JH, Lee JM, Hahn JY, Choi SH, Choi JH, Lee SH, Oh JH, Yu CW, Jeong JO, Gwon HC. Two-stent techniques for coronary bifurcation lesions (main vessel first versus side branch first): results from the COBIS (COronary Bifurcation Stenting) II registry. *EuroIntervention*. 2017;13:835-42.

Supplementary data

Moving Image 1. 3D OCT fly-through showing rewiring of the LAD through the first protruding strut of the diagonal stent.

Moving Image 2. 3D OCT fly-through showing rewiring of the diagonal artery through the distal stent cell of the bifurcation.

Moving Image 3. 3D OCT fly-through showing final results of the LAD/diagonal bifurcation.

The supplementary data are published online at:

<https://AsiaIntervention.pconline.com/>

doi/10.4244/AIJ-D-25-00038

