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Novel planned two-stent technique for bifurcation lesions: Inverted compression T-stenting

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Percutaneous coronary intervention (PCI) for bifurcation lesions accounts for 15–20% of all PCIs. A single-stent technique is recommended over a two-stent technique. However, some patients need a two-stent technique that is complex and time-consuming. A novel planned two-stent technique for bifurcation lesions, called inverted compression T-stenting (iCOTS), is proposed.

The schema of iCOTS is shown in Figure 1. First, a full two-link stent is deployed to the distal main vessel (DMV) with a slight protrusion to the bifurcation core. Next, a second two-link stent with a wide working range is deployed from the proximal main vessel (PMV) to the sidebranch. The proximal optimization technique (POT) is used to appose struts to the PMV. A wire-recrossed cell on the DMV ostium must be selected as a distal or middle cell without stent links. Dilation of the jailed DMV ostium followed by kissing balloon inflation (KBI) completes iCOTS.

A case with a left main bifurcation lesion treated with iCOTS is presented (Fig. 2A–C). A 3.0 × 38 mm Ultimaster Nagomi (UMN, Terumo, Tokyo, Japan), which is a full two-link stent, was deployed from the proximal to mid-left anterior descending artery (LAD) with a slight protrusion to the

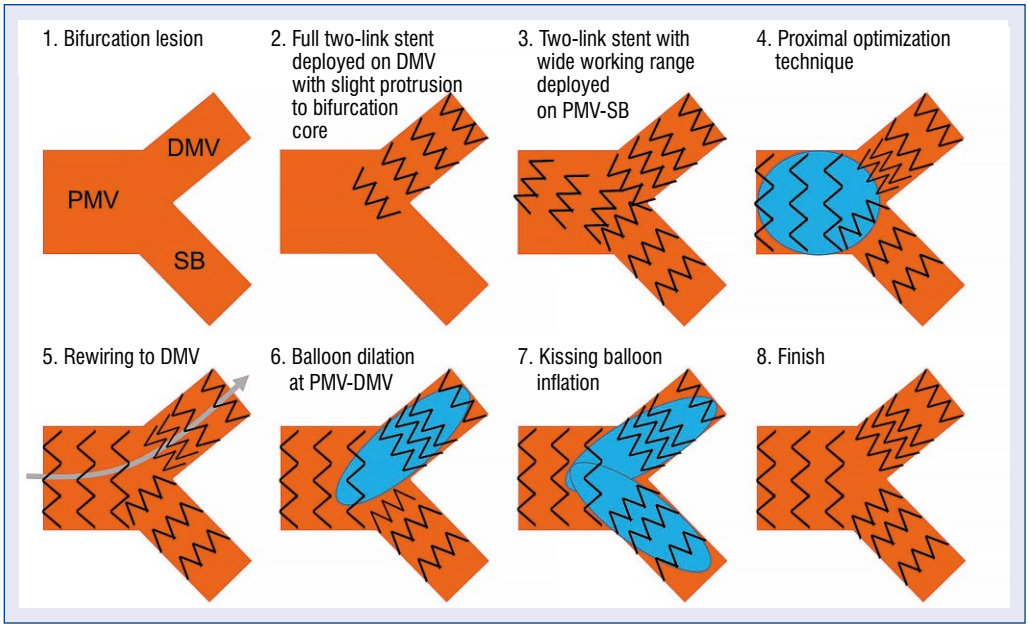

Figure 1. Schema of inverted compression T-stenting (iCOTS); PMV — proximal main vessel; DMV — distal main vessel; SB — sidebranch.

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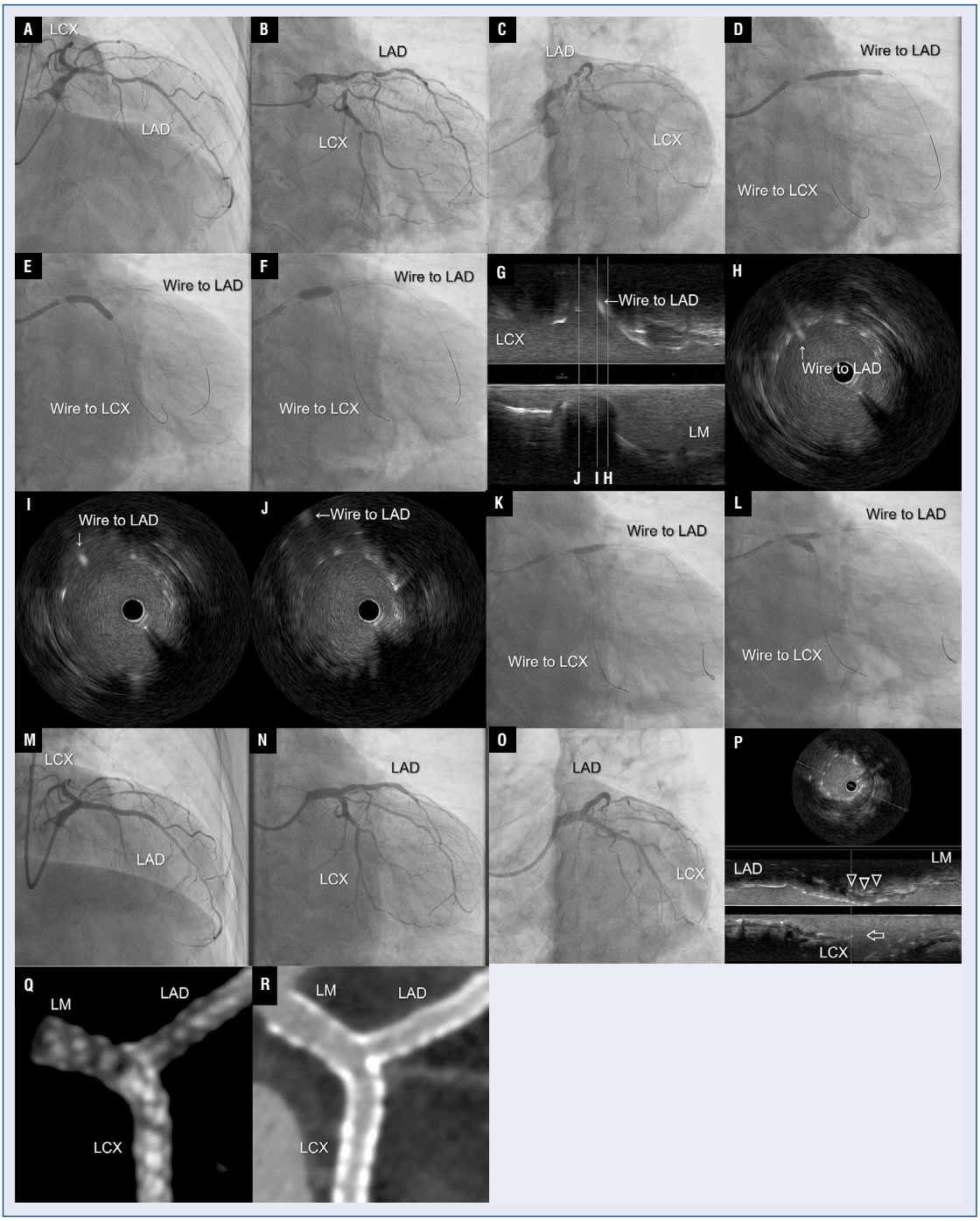

Figure 2. Baseline coronary angiography (CAG) of the right anterior oblique (RAO)-cranial view (**A**), the straight-caudal view (**B**) and the spider view (**C**); **D.** A 3.0 × 38 mm Ultimaster Nagomi (UMN) stent is deployed to the left anterior descending artery (LAD) with a slight protrusion to the left main bifurcation core; **E.** A 3.5 × 28 mm UMN stent is deployed from the left main coronary artery (LM) to the left circumflex artery (LCX); **F.** The proximal optimization technique with a 5.0 × 12 mm noncompliant balloon (NCB) at the LM; Longitudinal (**G**) and cross-sectional (**H–J**) intravascular ultrasonography (IVUS) shows the recrossed guidewire passes through the middle cell without stent links on the jailed LAD ostium; **K.** The jailed LAD ostium was dilated with a 3.5 × 12 mm NCB; **L.** Kissing balloon inflation with a 3.5 × 12 mm NCB from the LM to the LAD and a 4.0 × 12 mm NCB from the LM to the LCX. Final CAG showing the RAO-cranial view (**M**), the straight-caudal view (**N**), and the spider view (**O**); **P.** Final longitudinal IVUS shows a minimal metallic carina of the left main bifurcation (open arrow) and no stent gap between the LM and LAD (open arrowheads). The stent-focused angiographic view (**Q**) and the multiplanar reconstruction view (**R**) of the coronary computed tomographic angiography half a year post procedure, iCOTS showed no gap, minimal metallic carina, and no restenoses. Compressed struts on the just proximal LAD are presented as high intensity.

left main bifurcation core (Fig. 2D). A 3.5 × 28 mm UMN was deployed from the left main coronary artery (LM) to the mid-left circumflex artery (LCX) (Fig. 2E). POT was performed with a 5.0 × 12 mm noncompliant balloon (NCB) (Fig. 2F). Intravascular ultrasonography (IVUS, AltaView, Terumo, Tokyo, Japan) showed that the third guidewire recrossed to the LAD and passed through the middle cell without stent links on the jailed LAD ostium (Fig. 2G–J). The jailed LAD ostium was dilated with a 3.5 × 12 mm NCB (Fig. 2K). KBI was performed with a 3.5 × 12 mm NCB from the LM to the LAD and a 4.0 × 12 mm NCB from the LM to the LCX (Fig. 2L). The final coronary angiography showed good results (Fig. 2M–O), and the final longitudinal IVUS with a fast pullback speed (6 mm/s) showed a minimal metallic carina of the left main bifurcation and no stent gap between the LM and LAD (Fig. 2P). The stent-focused angiographic view (Fig. 2Q) and the multiplanar reconstruction view (Fig. 2R) of coronary computed tomographic angiography (CCTA) half a year after iCOTS showed no stent gap between the LM and LAD, minimal metallic carina, and no restenoses. Compressed struts on the just proximal LAD were seen as high intensity.

The first 6 cases of iCOTS for left main bifurcation lesions were attempted in our facility from August 2021 to January 2023, and all were successful. Follow-up CCTA was performed in 5 cases, excluding 1 case with chronic kidney disease, half a year after iCOTS. No stent gap between the LM and LAD and no restenoses cases were confirmed in all 5 cases.

A full two-link stent as a first stent has longitudinal compressibility that has been considered a disadvantage [1, 2]. Its proximal edge is moderately compressed by the deployment of a second stent. A second stent requires a two-link stent with a wide working range. Using POT and KBI [3, 4], the struts of the proximal part of the second stent are widely dilated and can cover the lateral shoulder of the DMV side at the bifurcation core. These characteristics may achieve no stent gap between the PMV and DMV without stent overlap.

In left main bifurcation stenting, LM-LCX stenting is advantageous for iCOTS. Because of its deep bifurcation angle, the stent link is less likely to be involved with the distal cell on the jailed LAD ostium [5]. With iCOTS, because of prior stenting on the DMV, loss of the DMV is less likely than it is with Culotte stenting (CS) [6], and that is advantageous in left main bifurcation PCI.

Compared with CS and double-kissing crush stenting (DKCS) [7, 8], iCOTS has less stent overlap. Struts on both branch ostia are not doubled in iCOTS unlike CS and DKCS [9, 10]. iCOTS has full single-layered cover or minimal stent overlap; therefore, CCTA after iCOTS can be evaluated like single stenting.

Based on our facility's experience, one to two crowns from the carina seem to be sufficient for protrusion of a first stent to the bifurcation core, although further study is required. Long protrusion can make it difficult to advance a second stent. In such a case, advancement of a second stent after balloon dilation from the PMV to the sidebranch or CS with rewiring through protruding struts should be considered. Insufficient protrusion causes gap formation between the PMV and DMV. To connect gap, additional CS is required [6].

iCOTS consists of fewer steps and may achieve full single-layered cover of a bifurcation with no stent gap between the PMV and DMV, and a minimal metallic carina. Although large-scale clinical studies are required, iCOTS may be a useful planned two-stent technique for bifurcation lesions.

Ethics approval

This study was approved by the institutional review board of Yamaguchi Grand Medical Center.

Conflict of interest: None declared

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