

# A novel application of the culotte stent technique to bail out a jailed common iliac artery

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## ABSTRACT

Implanting a self-expandable stent at the ostium of the common iliac artery (CIA) may lead to coverage of the orifice of the contralateral CIA. Here, we describe a novel application of the culotte stent technique using a balloon-expandable stent to bail out an ostial stenotic lesion of a jailed CIA due to prior self-expandable stent placement. The bilateral CIAs were revascularized by culotte stenting, and patency of the stents was confirmed 3 years after the procedure. The culotte stent technique was successfully applied to an ostial stenotic lesion of a jailed CIA. (J Vasc Surg Cases and Innovative Techniques 2017;3:236-9.)

Balloon-expandable stents (BESs) or stent grafts are typically favored by many for treating common iliac artery (CIA) occlusive disease because of their deployment accuracy and radial strength. However, self-expandable stents (SESs) are also used in patients with strong calcification or tortuosity at the lesion site because they have a lower risk of extravasation, dissection, and vessel rupture compared with BESs, which require high pressure and long balloon inflation.<sup>1</sup> Deployment of an SES to the exact site is technically challenging compared with that of a BES. Therefore, when an SES is applied at an ostium of the CIA, the protruding SES from the CIA to the abdominal aorta can be jailed to the opposite side of the CIA. We describe a novel application of the culotte stent technique for treating an ostial stenotic lesion of a jailed CIA caused by prior SES placement. Consent to publish this case was obtained from the patient.

## CASE REPORT

A 62-year-old woman had a medical history of hypertension, dyslipidemia, and coronary artery disease. She underwent percutaneous coronary intervention (PCI) three times. She was admitted with left calf claudication diagnosed as peripheral

artery disease with total left CIA occlusion. Endovascular therapy (EVT) was performed, and an SES (10.0 × 60-mm S.M.A.R.T. Control; Cordis, Bridgewater, NJ) was placed. However, an SES protruding from the left CIA into the abdominal aorta accidentally jailed the right CIA (Fig 1, A). No additional EVT was performed for the jailed right CIA because the protruded SES did not cause flow limitations in the right CIA. Because the symptoms disappeared after the first EVT, follow-up computed tomography and ultrasound were not performed. The patient was maintained on 100 mg aspirin and 75 mg clopidogrel daily.

One year after the first EVT, the patient complained of right calf claudication. The ankle-brachial indexes (ABIs) were 0.61 and 0.90 on the right and left sides, respectively, suggesting right leg ischemia. Angiography revealed the progression of stenosis at the ostium of the right CIA, which was completely jailed by the previously implanted S.M.A.R.T. Control (Fig 1, B). We recommended bypass surgery, but she refused treatment. Thus, we decided to perform EVT.

A 0.014-inch Chevalier floppy guidewire (Cordis) was advanced from the right femoral artery and passed to the abdominal aorta through the cell of the S.M.A.R.T. Control because the proximal edge of the protruded S.M.A.R.T. Control from the left CIA was solidly fixed to the aortic wall. A 0.014 Chevalier universal guidewire (Cordis) was then advanced from the left femoral artery. The right CIA ostial stenosis was dilated with a 6.0-mm balloon (Aviator 6.0 × 20 mm; Cordis); it dissected the right CIA (Fig 2, A). Therefore, the culotte stent technique with a BES (10.0 × 37-mm Express LD; Boston Scientific, Marlborough, Mass) was used to bail out the right CIA dissection. Because the Express LD could not pass through the cell of the S.M.A.R.T. Control, we attempted to advance a 7F sheath through the cell of the S.M.A.R.T. Control as a protective sheath. However, the 7F sheath could not pass through the cell of the S.M.A.R.T. Control. Finally, the 7F sheath could pass through the cell of the S.M.A.R.T. Control through dilating the cell of the S.M.A.R.T. Control with the Sleek 2.0/4.0 (Cordis; Fig 2, B). The Express LD was deployed with nominal pressure (10 atm) for culotte stenting. After deployment of the Express LD, a Chevalier universal guidewire was recrossed through

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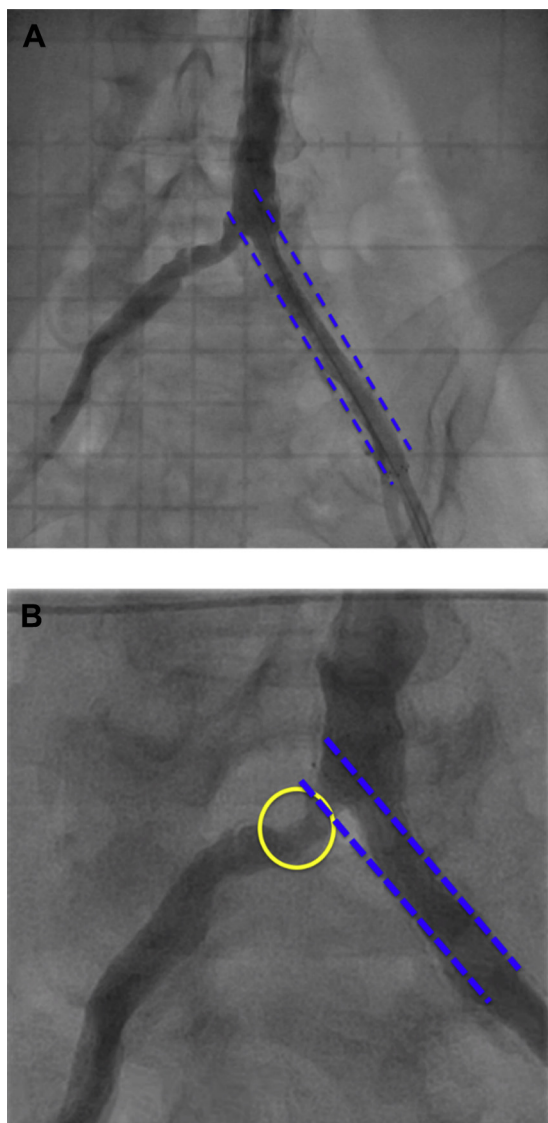
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**Fig 1.** The first endovascular therapy (EVT) resulted in successful revascularization of the left common iliac artery (CIA) with a self-expandable stent (SES; blue dotted lines). However, a protruded SES from the left CIA accidentally jailed the right CIA (yellow circle; **A**). One year after the first EVT, a progressed stenosis at the ostium of the right CIA, which was completely jailed by the previously implanted SES, was confirmed (**B**).

the cell of the Express LD. We confirmed this by intravascular ultrasound. Finally, kissing balloon dilation was performed with a 6.0- × 20-mm balloon for the right CIA and 8.0- × 20-mm balloon for the left CIA. In performing kissing balloon dilation, we intended to dilate the Express LD with an undersized balloon because there was fear of aortic rupture. Adequate stent and cell dilation was confirmed by intravascular ultrasound, and final angiography showed successful revascularization (Fig 2, C). Immediately after this procedure, the ABI on the right side increased from 0.61 to 0.90, whereas the ABI on the left side did not change (0.90 to 0.92). The patient was free from claudication 18 months after the second

EVT, and bilateral ABIs did not decrease. We performed follow-up angiography during follow-up coronary angiography; results showed stent patency.

## DISCUSSION

We demonstrated a successful EVT using a culotte stent technique for the ostial stenotic lesion of a jailed CIA. For the treatment of coronary bifurcation lesions, culotte stenting is one of the standard techniques. The origin of *culotte* comes from a culotte skirt because the design of this technique resembles the culotte skirt. The culotte stent technique consists of sequential implantation of two stents into both branches, with the main branch stent implanted through the side branch stent and protruding into the main branch lumen. This technique is suitable for all angles of bifurcation and provides good coverage of the side branch ostium.<sup>2</sup> There is currently no published report of culotte stenting applied for bilateral CIAs.

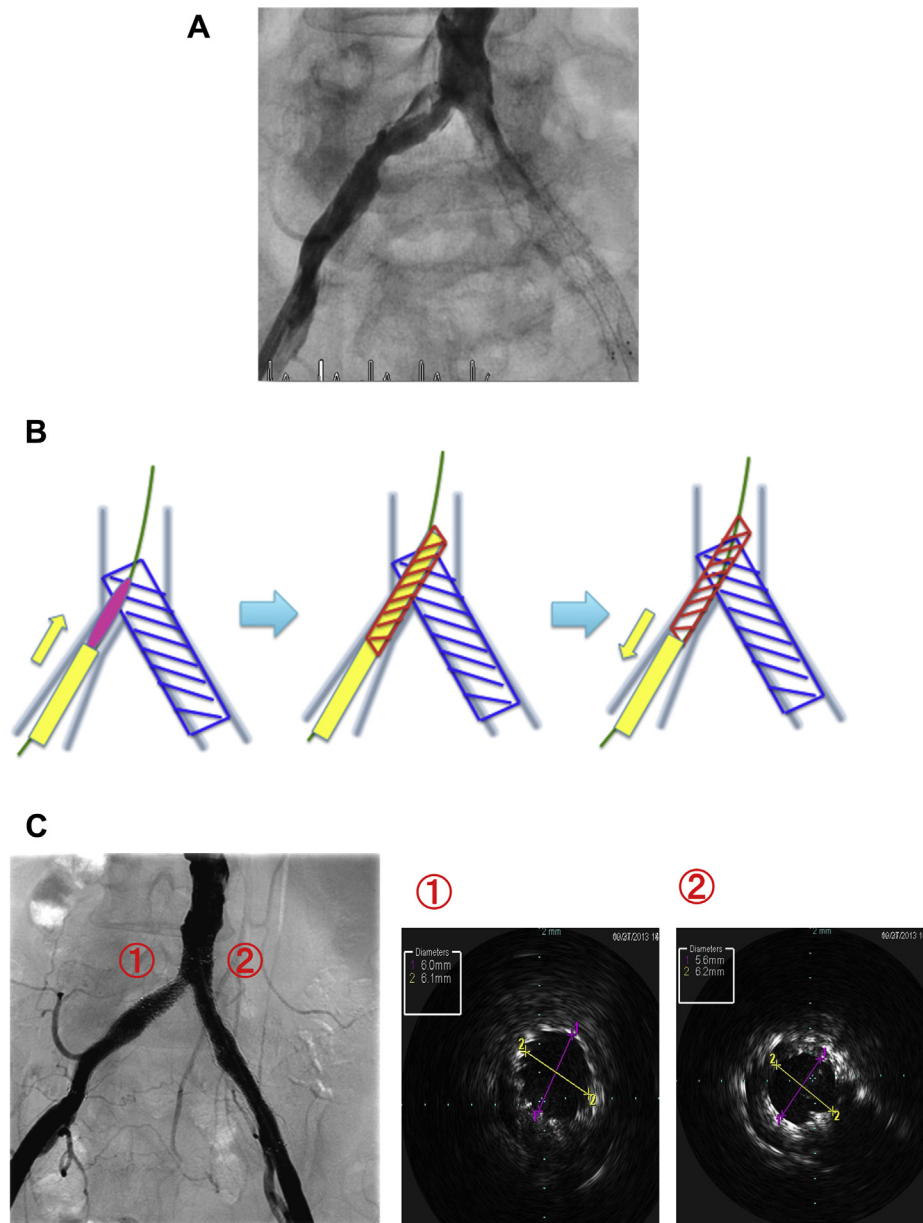
The iliac arteries are important access routes for PCI. Kissing stent reconstruction is the most effective and established strategy for aortoiliac bifurcation lesions<sup>3</sup> and can maintain two access routes from the femoral arteries to the heart. When the kissing stent is not available, T-stenting with small protrusion technique and T-stenting are reported as alternative strategies.<sup>4</sup> However, T-stenting cannot maintain two access routes. In T-stenting with small protrusion technique, the protruded stent could be an obstacle between the femoral arteries and the heart.

We needed to treat the right CIA while maintaining two access routes (Fig 3, A) for scheduled PCI after EVT. We considered kissing stenting adequate, if enough space could be created outside the first implanted stent to advance the second stent.<sup>5</sup> We found that the proximal edge of the S.M.A.R.T. Control adhered to the aortic wall. Thus, we abandoned the kissing stent technique and instead performed the culotte stent technique as an alternative.

However, inexact SES placement at the left CIA during the first EVT made it difficult to treat an ostium stenotic lesion of the right CIA, and arterial dissection of this site caused by balloon dilation inevitably required bailout stenting.

To confirm whether an Express LD could be dilated sufficiently, a change of stent structures in culotte stenting was validated extracorporeally. An Express LD (10 × 37 mm) was placed in a cell of the S.M.A.R.T. Control (10 × 40 mm), and the Express LD was then dilated with a balloon. This procedure revealed that a balloon >7 mm could break the bridge between struts of the S.M.A.R.T. Control, which could make it possible to dilate the Express LD sufficiently and to maintain its scaffolding (Fig 3, B).

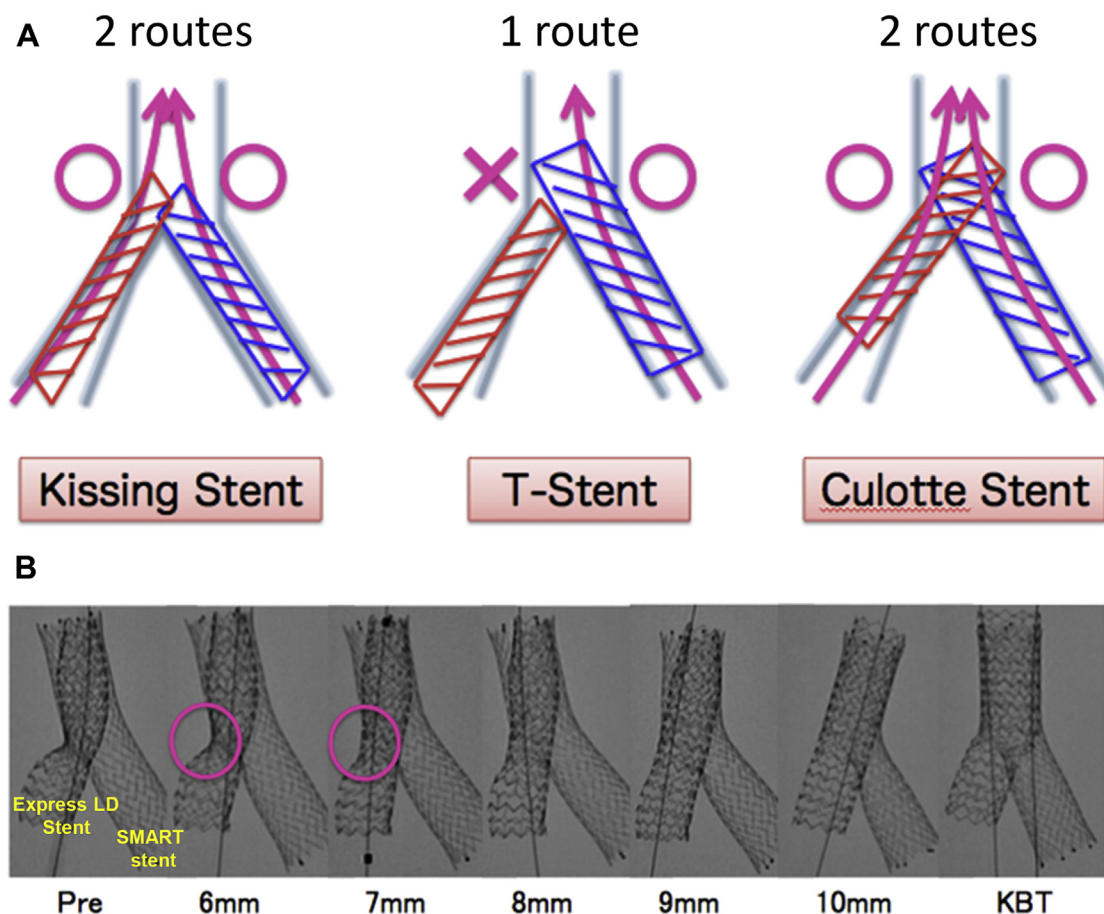
There was concern about the long-term durability of both implanted stents. However, 18-month follow-up



**Fig 2.** Representative angiograms of the second endovascular therapy (EVT; **A** and **C**) and a schematic of the protective sheath technique (**B**). Arterial dissection occurred after balloon dilation at the ostial stenosis of the right common iliac artery (CIA; **A**). Culotte stenting was applied to bail out the ostial stenosis. A protective sheath technique was used to introduce a balloon-expandable stent (BES) between the stent struts of the self-expandable stent (SES; **B**). Final angiography and intravascular ultrasound demonstrated successful culotte stenting with adequate stent dilation (**C**).

angiography showed stent patency. Our ex vivo experiment revealed that kissing balloon dilation did not destroy the architecture of either stent, although it caused a single strut fracture of the S.M.A.R.T. Control, which was categorized as a type 1 stent fracture. A

previous study showed that a type 1 stent fracture did not affect patency in infrapopliteal lesions.<sup>6</sup> The result of this case cannot be applied to other stents because we used only a combination of the S.M.A.R.T. Control and Express LD in our experiment.



**Fig 3. A,** Schematic images of the kissing stent, T-stent, and culotte stent techniques. Both kissing stent and culotte stent techniques can keep two routes open from the femoral arteries to the aorta and heart after the procedures. **B,** Extracorporeal validation to evaluate a change of stent structures in culotte stenting. An Express LD stent (10 × 37 mm) was placed between struts of the SMART stent (10 × 40 mm). A >7-mm balloon could be used to break the strut of the SMART stent and could dilate the Express LD stent sufficiently (circles). KBT, Kissing balloon technique.

## CONCLUSIONS

The culotte stent technique is a viable option for treating an ostial stenotic lesion of a jailed CIA.

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