Outcomes of the single-stent versus kissing-stents technique in asymmetric complex aortoiliac bifurcation lesions

Yongsung Suh, MD,[a] Young-Guk Ko, MD,[b] Dong-Ho Shin, MD,[b] Jung-Sun Kim, MD, PhD,[b] Byeong-Keuk Kim, MD, PhD,[b] Donghoon Choi, MD, PhD,[b] Myeong-Ki Hong, MD, PhD,[b] and **Yangsoo Jang, MD, PhD,[b]** *Goyang-si, Gyeonggi-do and Seoul, Korea*

Objective: **This study investigated the outcomes of single-stent vs kissing-stents techniques in asymmetric complex aortoiliac bifurcation (ACAB) lesions.**

Methods: **We retrospectively investigated 80 consecutive patients (69 males, 66.6 ± 8.7 years) treated with a single stent and 30 patients (26 males, 67.1 ± 7.7 years) treated with kissing stents for ACAB between January 2005 and December 2012 from a single-center cohort. A ACAB lesion was defined as a symptomatic unilateral common iliac artery stenosis (>50%) combined with intermediate stenosis (30%-50%) in the contralateral common iliac artery ostium. The primary end point was the primary patency of the ACAB.**

Results: **The baseline clinical characteristics did not differ significantly between the single-stent and the kissing-stents group. Technical success was achieved in all patients. The single-stent group required fewer stents (1.3 ± 0.5 vs 2.3 ± 0.8; $P < .001$) and less bilateral femoral access (55% vs 100%; $P < .001$). Two patients in the single-stent group (3%) required bailout kissing stents because of plaque shift to the contralateral side. The major complication rates were 8% in single-stent vs 13% in the kissing-stent group, which was similar ($P = .399$). At 3 years, the single-stent and kissing-stents group had similar rates of primary patency (89% vs 87%; $P = .916$) and target lesion revascularization-free survival (93% vs 87%; $P = .462$).**

Conclusions: **The single-stent technique in ACAB was safe and showed midterm outcomes comparable with those of kissing stents. Considering the benefits, such as fewer stents, less bilateral femoral access, and the availability of contralateral access for future intervention, the single-stent technique may be an advantageous treatment option in ACAB. (J Vasc Surg 2015;62:68-74.)**

With the rapid evolution of endovascular therapy devices and experience of practitioners, increasingly complex peripheral artery lesions are becoming candidates for endovascular treatment. Endovascular intervention is now the preferred option for treating obstructive atherosclerotic diseases of the distal aorta and iliac arteries. Recent European guidelines recommend an endovascular-first strategy for aortoiliac Trans-Atlantic Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC) II type A, B, and C lesions.[1] The kissing-stents technique, first described by Kuffer et al,[2] has been adopted for endovascular treatment of complex aortoiliac bifurcation lesions involving the distal aorta and bilateral ostia of common iliac arteries (CIAs).[3] Even asymmetric aortoiliac lesions involving unilateral CIA ostium have been treated with kissing stents due to concerns about unfavorable plaque shifting and embolization to the contralateral iliac artery.[3,4]

However, the kissing-stents technique requires more devices, bilateral femoral artery access, and usually results in a loss of the future contralateral access option for endovascular treatment of distal lesions. Currently, there is no generally established consensus on how to treat unilateral aortoiliac bifurcation lesions. Especially, if a unilateral bifurcation lesions has an intermediate stenosis in the contralateral CIA ostium, whether the single-stent or kissing-stents technique is a better stenting strategy remains unknown. Thus, the purpose of the present study was to compare the outcomes of the single-stent vs kissing-stents techniques for the treatment of asymmetric complex aortoiliac bifurcation (ACAB) lesions.

METHODS

The protocol of this study conforms to the ethical guidelines of the 1975 Declaration of Helsinki. The Institutional Review Board approved this study and waived the requirement for informed consent due to its retrospective design.

From the Department of Cardiology, Myongji Hospital, Goyang-si, Gyeonggi-do[a]; and the Division of Cardiology, Severance Cardiovascular Hospital & Cardiovascular Research Institute, Yonsei University College of Medicine, Seoul.[b]

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Reprint requests: Young-Guk Ko, MD, Division of Cardiology, Severance Cardiovascular Hospital & Cardiovascular Research Institute, Yonsei University College of Medicine, 50 Yonsei-ro, Seodaemun-gu, Seoul 120-752, Korea (e-mail: ygko@yuhs.ac).

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Study population. We retrospectively reviewed angiographic findings of 439 patients who received endovascular treatment with stent implantation for atherosclerotic aortoiliac diseases from January 2005 to December 2013. Of these patients, 110 met the following inclusion criteria: presence of symptomatic unilateral CIA stenosis (>50%) and intermediate stenosis (30%-50%) in the contralateral CIA ostium, according to a catheter-based angiography, and aortoiliac bifurcation lesions treated with a single stent or kissing stents. We excluded aortoiliac diseases without involvement of the CIA ostium (lesions >1 cm distal from the bifurcation), aortoiliac bifurcation lesions with significant (>50%) stenosis of the adjacent aorta, or aortoiliac bifurcation lesions previously treated with stents.

The study included 110 patients, of which 80 were treated with a single stent and 30 were treated with kissing stents. Before the angioplasty procedure, all patients underwent physical evaluations, a noninvasive hemodynamic evaluation (including segmental blood pressures, ankle-brachial index [ABI], and pulse volume recording), and at least one imaging test (computed tomography [CT], magnetic resonance angiography, or color duplex ultrasound imaging).

Procedure and periprocedural management. Procedures were routinely performed under local anesthesia supported by intravenous sedatives with cardiopulmonary monitoring. After puncture, heparin (5000 IU) was administered intra-arterially. Additional doses of heparin were added during the procedure, if necessary, to maintain an activated clotting time >250 seconds.

In general, single stents were implanted using a retrograde approach via the ipsilateral common femoral artery (CFA) or using a crossover approach via the contralateral CFA, whereas kissing stents were implanted using a bilateral retrograde CFA approach. In cases where the distal aorta or CIA was totally occluded, additional brachial artery access was obtained at the operator's discretion.

Lesions were crossed with 0.018-inch or 0.035-inch wires. In cases of total occlusion, the intraluminal or intentional subintimal technique was used for passage of wires, according to the operator's preference. All lesions with stenosis >50% were predilated using balloons (6-8 mm) smaller than the reference vessel diameter. Predilated lesions were routinely treated by implantation of a Palmaz Genesis (Cordis, Warren, NJ) or Express (Boston Scientific, Natick, Mass) balloon-expandable stent, or Smart (Cordis, Miami Lakes, Fla), Zilver (Cook Medical, Bloomington, Ind), Absolute Pro LL (Abbott Vascular, Abbott Park, Ill), or Hercules (S & G Biotech, Seongnam, Gyeonggi-do, Korea) self-expandable stents. Self-expandable stents were usually preferred for long-segment or tortuous lesions, whereas balloon-expandable stents were generally used for short-segment lesions of the CIA. Stent diameters ranged from 7 to 10 mm. Balloon-expandable stents were chosen to match the vessel size. Self-expandable stents were 1 mm oversized to the vessel diameter.

In the single-stent technique, a stent was implanted to cover the ostium of the target CIA with minimal protrusion of the stent into the aorta, without obstructing the entry into the contralateral iliac artery. In the kissing-stents technique, two stents were implanted, one in each CIA, protruding into the aorta and making parallel contact. All self-expandable stents were routinely postdilated to the reference vessel size. Additional poststent dilation was performed for all stents where residual stenosis was >30%.

All patients received maintenance doses of aspirin (100 mg) and clopidogrel (75 mg) for at least 5 days before the procedure or loading doses of aspirin (250 mg) and clopidogrel (300 mg) 1 day before the procedure. After the procedure, dual-antiplatelet therapy of aspirin (100 mg) and clopidogrel (75 mg) was maintained for at least 1 month.

Follow-up. Patients were evaluated after discharge in regular clinical follow-up visits at 3-month intervals for 1 year and then at 6-month intervals thereafter. After the procedure, noninvasive hemodynamic evaluations were performed on all patients before discharge from the hospital and thereafter regularly every 6 months or in cases of symptom deterioration. At least one imaging test (CT angiography, color duplex ultrasound imaging, or intra-arterial angiography) was performed at 1 year, or in cases with a >0.15 decrement in ABI or if symptoms worsened by one Rutherford category during follow-up.

Definitions. The index target vessel was a symptomatic CIA with ostial stenosis >50% according to a catheter-based angiography. Technical success was defined as successful stent implantation at the target vessel with residual stenosis <30% on postprocedural angiography. The primary end point was the primary patency of both CIAs, defined as (1) the absence of binary restenosis (≥50%) measured by CT angiography, invasive angiography, or duplex ultrasound imaging, and (2) a decrease in ABI >0.15 between postprocedure and follow-up. Peak velocity >180 cm/s or a lesion/adjacent segment velocity ratio >2.4 by duplex imaging was considered a significant (≥50%) stenosis.

Secondary end points included survival free of target lesion revascularization (TLR) and major adverse events (MAEs). A MAE was defined as a composite of all-cause death, binary restenosis of the aortoiliac bifurcation, TLR, or unplanned amputation. Major procedural complications were defined as all-cause death, complications requiring intervention, or unplanned amputation ≤30 days after the procedure.

Statistical analysis. Continuous variables are expressed as means ± standard deviation and categoric variables as number and percentage. Comparisons of continuous variables between the single-stent and the kissing-stents group were performed using the Student *t*-test. Categoric variables were compared using a χ^2 or Fisher exact test, as appropriate. Comparisons of variables before and after the procedure were performed using a paired *t*-test. Primary and secondary end points were determined using Kaplan-Meier survival analysis and