

# Custom-made iliac fenestrated endoprosthesis for the treatment of internal iliac artery aneurysm with preservation of the superior gluteal artery

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## ABSTRACT

A 56-year-old man with huge bilateral internal iliac artery aneurysms (IIAAs) had emergently undergone right common iliac artery replacement. Intermittent claudication was induced by 8 minutes of walking on postoperative day 16. Endovascular repair using a custom-made iliac fenestrated endoprosthesis for the treatment of the left IIAA with preservation of the superior gluteal artery was performed on postoperative day 20 without discharging the patient. The patient had no ischemic complications. When an IIAA with a short length (<55 mm) and large diameter (>21 mm) of the common iliac artery is anatomically suitable, the placement of a custom-made iliac fenestrated endoprosthesis is a feasible and effective technique. (*J Vasc Surg Cases Innov Tech* 2021;7:532-5.)

**Keywords:** Endovascular aneurysm repair; Iliac branch endoprosthesis; Internal iliac artery aneurysm; Pelvic circulation; Superior gluteal artery

A commercially available iliac branch endoprosthesis (IBE) can reduce ischemic complications after endovascular bilateral common iliac artery (CIA) aneurysm repair. However, ischemic complications after bilateral internal iliac artery (IIA) aneurysm repair remain an issue. Our patient provided written informed consent for the report of the details and images for his case.

## CASE REPORT

A 56-year-old man with a left CIA aneurysm (35 mm), a ruptured right IIA aneurysm (IIAA; 74 × 112 mm), and an asymptomatic left IIAA (47 × 80 mm) had emergently undergone right CIA replacement with interruption of the branches of the right IIAA. Physical therapy was started on postoperative day (POD) 1. Contrast-enhanced computed tomography (CT) on POD 10 showed exclusion of the right IIAA and enlargement of the left IIAA to 54 × 80 mm (Fig 1). The length of the proximal landing zone of the left CIA aneurysm was 20 mm, and the diameter ranged from 17 to 24 mm. The length and diameter of the left CIA were 50 and 35 mm, respectively. The diameter of the left

external iliac artery (EIA) ranged from 10 to 11 mm. The diameter of the left superior gluteal artery (SGA) ranged from 6.6 to 8.0 mm. Intermittent claudication was induced by 3 minutes of walking on POD 10 and by 8 minutes of walking on POD 16. The patient had no symptoms at rest. We planned an endovascular repair with a custom-made iliac fenestrated endoprosthesis (IFE) using a fenestrated and inverted Endurant II contralateral limb (Medtronic, Santa Rosa, Calif) and Viabahn (W.L. Gore & Associates, Inc, Flagstaff, Ariz) with preservation of the left SGA to prevent ischemic complications, because a commercial device was contraindicated. Although a Gore Excluder iliac branch endoprosthesis (IBE; W.L. Gore & Associates) is only one of the IBE devices available in Japan, the 50-mm length of the left CIA in the present case was too short and the >21-mm diameter of the CIA was too large for a Gore IBE. The patient provided written informed consent before surgery. The operation was performed with the patient under general anesthesia in a hybrid operating room on POD 20 without discharging the patient. The patient was placed in a supine position, and the bilateral femoral artery (FA) was exposed. First, the left inferior gluteal artery and obturator artery were interrupted by coil embolization. Next, an Endurant II contralateral limb was deployed on a clean table, and a 6-mm fenestration was made at the graft between the fourth and fifth stents. A boiled Azur D-18 Helical HydroCoil (Terumo Corp, Tokyo, Japan) 6 mm in size was sutured to the graft at the margin of the fenestration with 6-0 polypropylene sutures using knotted sutures as a radiopaque marker to prevent an endoleak at the junction site (Fig 2, A). The Endurant II contralateral limb was then inadvertently resheathed in the original sheath of the Endurant II. The fenestrated and inverted Endurant II contralateral limb delivery system was directly inserted from the left FA and half deployed in the position at which the radiopaque marker was positioned at the orifice of the left IIAA (Fig 2, B and C). A guidewire was passed into the left SGA through the fenestration from the right FA and then replaced with a super-stiff guidewire. A

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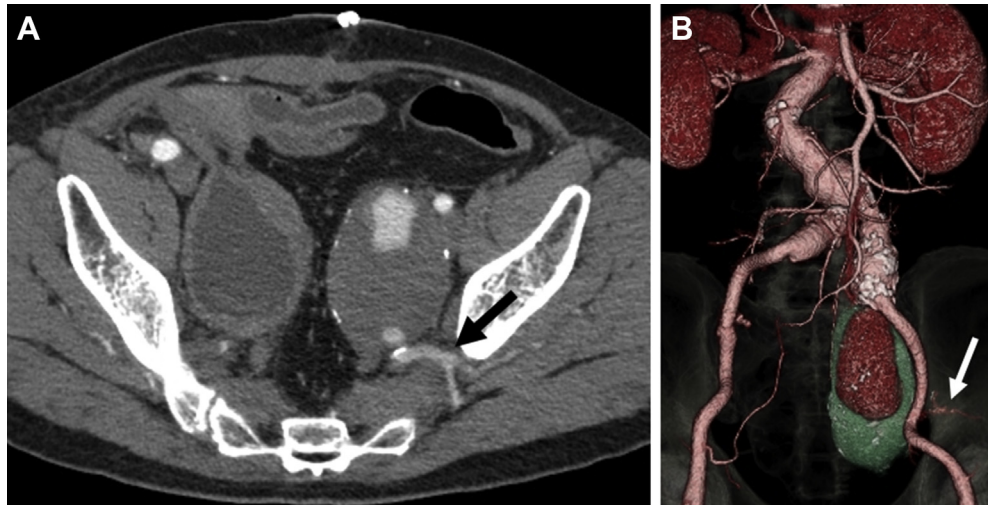
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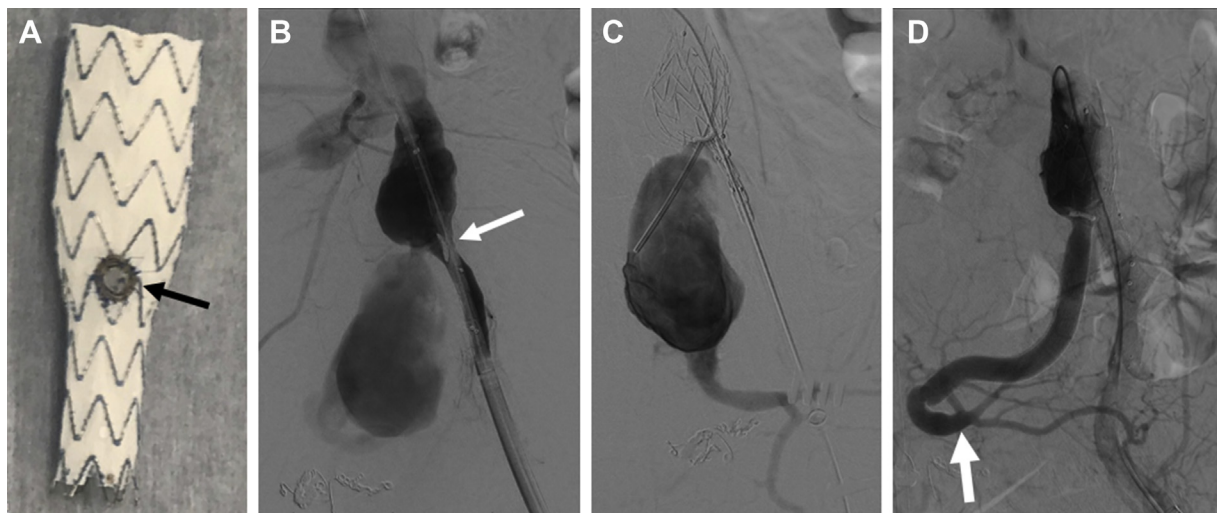
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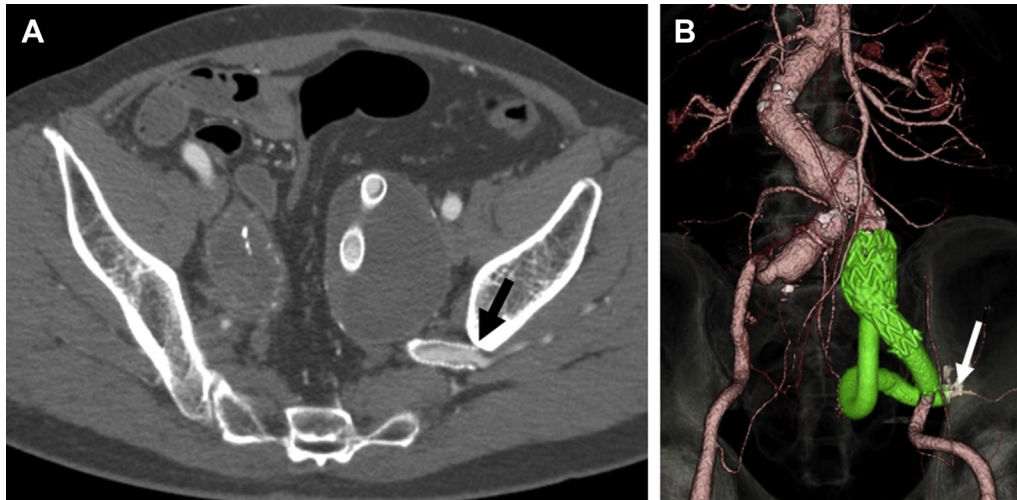
**Fig 1.** **A**, Contrast-enhanced computed tomography scan showing a huge left internal iliac artery aneurysm (IIAA) and the left superior gluteal artery (SGA; arrow). **B**, Three-dimensional computed tomography angiogram showing exclusion of the right IIAA, left common iliac artery (CIA) aneurysm, huge left IIAA, and left SGA (arrow).



**Fig 2.** **A**, Intraoperative photograph showing an Endurant II contralateral limb deployed on a clean table, and a 6-mm fenestration was made at the graft between the fourth and fifth stents. A boiled Azur D-18 Helical HydroCoil (Terumo Corp, Tokyo, Japan) 6 mm in size was sutured to the graft at the margin of the fenestration with 6-0 polypropylene sutures using knotted sutures as a radiopaque marker (arrow). **B**, Operative angiogram showing that the fenestrated (arrow) and inverted Endurant II contralateral limb delivery system was directly inserted via the left femoral artery. **C**, The fenestrated Endurant II was half-deployed in the position at which the radiopaque marker was positioned at the orifice of the left internal iliac artery aneurysm (IIAA). **D**, Completion angiogram showing no evidence of an endoleak with preservation of the superior gluteal artery (SGA; arrow).

Viabahn stent 9 mm in diameter was deployed from 10 mm inside the fenestration to the left SGA, and the Endurant II stent was then fully deployed from the left CIA to the left EIA. Touch-up balloon dilatation of the stent grafts was performed at the proximal and distal landing and junction sites. Finally, a self-expanding nitinol stent, an Epic Vascular stent, 10 mm × 60 mm (Boston Scientific Corp, Marlborough, Mass), was deployed from the portion of the Endurant II placed in the left EIA to the native left EIA to maintain graft patency. A

completion angiogram (Fig 2, D) and contrast-enhanced CT scan 5 days after endovascular repair showed no evidence of an endoleak with preservation of the left SGA. The patient had no ischemic complications and was discharged 7 days after endovascular repair. At 12 months postoperatively, the patient had no complaints, and contrast-enhanced CT (Fig 3) showed no evidence of an endoleak, with preservation of the left SGA. In addition, the left IIAA had decreased in size. Eighteen months later, the patient had no complaints.



**Fig 3.** **A**, Contrast-enhanced computed tomography scan at 12 months postoperatively showing no evidence of endoleak with preservation of the left superior gluteal artery (SGA; arrow). **B**, Twelve months later, three-dimensional computed tomography angiogram showing exclusion of the left internal iliac artery aneurysm (IIAA) with preservation of the superior gluteal artery (SGA; arrow).

## DISCUSSION

It is usually difficult to preserve pelvic collateral pathways, such as the medial femoral circumflex artery–obturator artery–gluteal artery pathway, when treating IIAAs.<sup>1</sup> Although no commercial endovascular repair devices for the treatment of IIAAs are currently available, a few techniques for treating IIAAs and preserving the SGA to prevent ischemic complications has been reported.<sup>2–5</sup> Noel-Lamy et al<sup>2</sup> treated IIAAs using a Zenith branch iliac endovascular graft (Cook Medical, Bloomington, Ind) with extension of the internal iliac component of the branch stent-graft into the SGA. Furthermore, Jerkku et al<sup>6</sup> reported that extension of the Zenith branch graft into the SGA was a technically feasible and safe maneuver in the treatment of aortoiliac aneurysms, with outcomes comparable to those when the Zenith branch graft was extended to the main trunk of the IIA in the midterm. However, the Zenith branch graft is not available in Japan. Furthermore, Cornwall et al<sup>3</sup> treated an IIAA using a Gore IBE with preservation of gluteal perfusion. In addition, D’Oria et al<sup>7</sup> reported that the use of the posterior or anterior division of the IIA as a distal landing zone for the Gore IBE was safe and efficacious in the midterm. In contrast, a few techniques for IIAA repair to preserve the SGA without the use of the Zenith branch graft or Gore IBE have been reported. Domoto et al<sup>4</sup> treated isolated IIAAs with a proximal neck length >5 mm using a Viabahn to preserve the SGA. In the present patient, no proximal neck was present at the IIAA. Another technique for IIAA repair is the parallel stent-graft technique.<sup>5</sup> The custom-made IFE used in the present patient is a new technique for achieving IIAA repair to preserve the pelvic circulation. We believed that repair of the IIAA with preservation of the SGA

supplying the gluteal muscles would relieve the intermittent claudication more effectively than exclusion of the IIAA. In addition, given the risk of mesenteric ischemia, we considered preservation of the inferior mesenteric artery desirable. The surgeon-modified fenestrated Endurant II contralateral limb that was previously reported<sup>8</sup> was used while being inadvertently resheathed and combined with a Viabahn stent-graft to preserve the left SGA, and an Azur D-18 Helical HydroCoil (Terumo Corp) coated by hydrogel that expands in the blood was selected as a radiopaque marker to prevent both an endoleak at the junction site and the migration of the Viabahn in the present case. If available, a balloon-expandable covered stent would be more effective than a self-expandable one as a combinational branch. Furthermore, if possible, the use of a steerable sheath or the brachial artery as an access site might make the procedure easier to perform.

## CONCLUSIONS

When an IIAA with a short length (<55 mm) and large diameter (>21 mm) of the CIA is anatomically suitable, placement of a custom-made IFE could be a potentially feasible and effective technique. However, careful follow-up is needed, because the long-term outcomes are unknown.

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