

# Inferior Mesentery Artery and Internal Iliac Artery Preservation with Covered Self-Expanding Stents during Endovascular Aneurysm Repair

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We report an endovascular aneurysm repair in a patient with isolated bilateral common iliac artery aneurysms, a prominent inferior mesentery artery (IMA), and bilateral proximal internal iliac artery (IIA) aneurysms using covered self-expanding stents to preserve the IMA and bilateral internal iliac arteries. A follow-up computed tomography angiography was obtained at 1 month. Pelvic circulation was well preserved without bowel ischemia. IMA and bilateral IIA preservation with covered self-expanding stents during endovascular aneurysm repair is a safe and effective method.

**Key Words:** Iliac artery, Stents, Mesenteric artery, Inferior

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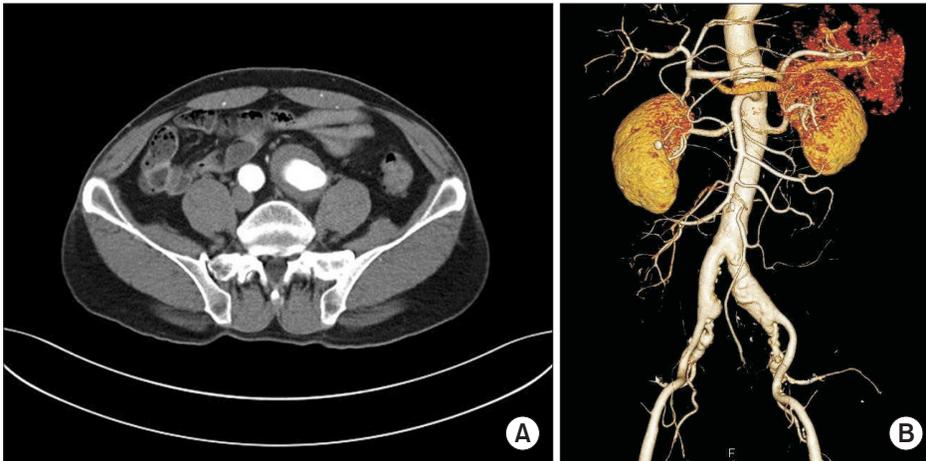
## INTRODUCTION

Isolated iliac artery aneurysms (IIAAs) are rare, accounting for 2%-7% of all abdominal aneurysmal diseases [1]. IIAAs are associated with a high risk of rupture and death [2]. The majority of IIAAs primarily involve the common iliac artery (CIA; 70%-90% of cases), and approximately 20%-25% affect the internal iliac arteries (IIAs). Occlusion of the IIA could impair pelvic flow when repairing an iliac aneurysm with an endovascular device. We report a case of inferior mesentery artery (IMA) and IIA preservation with covered stents during endovascular aneurysm repair (EVAR).

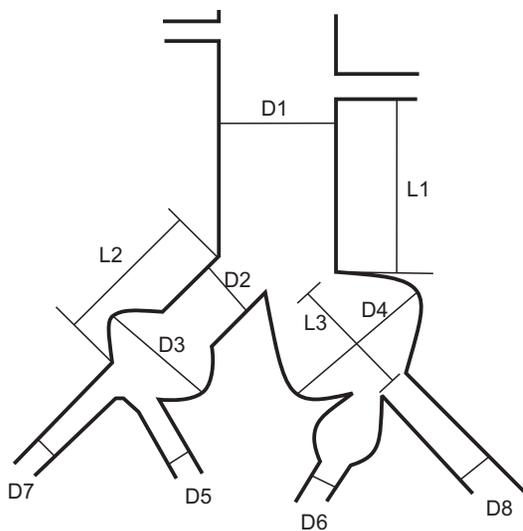
## CASE

A 62-year-old man presented to our hospital with lower abdominal pain. He had undergone a coronary artery bypass graft (CABG) due to myocardial infarction. Bilateral iliac artery aneurysms (IIAAs) were found when he received the CABG. About 6 months after the operation, a follow-up computed tomography (CT) angiography showed a more prominently enlarged partially thrombosed fusiform aneurysm in the left CIA (average diameter of about 4 cm) (Fig. 1). Fig. 2 shows preoperative measurements including D1-D8, L1-L3.

Under general anesthesia, he was cut down on both inguinal areas and the right upper arm. An 8-Fr long sheath (Terumo, Tokyo, Japan) was inserted via the right



**Fig. 1.** (A) Computed tomography image shows that the diameter of the common iliac artery (CIA) was 22 mm on the right and 43 mm on the left. (B) Volume rendering reconstructed image shows fusiform aneurysms in the left CIA involving the proximal left internal iliac artery (IIA) and aneurysmal dilatation of the right CIA with aneurysms on bilateral proximal IIA.



**Fig. 2.** Preoperative measurements including D1–D8, L1–L3 (D1: 23 mm, D2: 12 mm, D3: 22.7 mm, D4: 43.26 mm, D5: 5.6 mm, D6: 6.4 mm, D7: 7.5 mm, D8: 7.8 mm, L1: 100 mm, L2: 50 mm, L3: 55 mm).

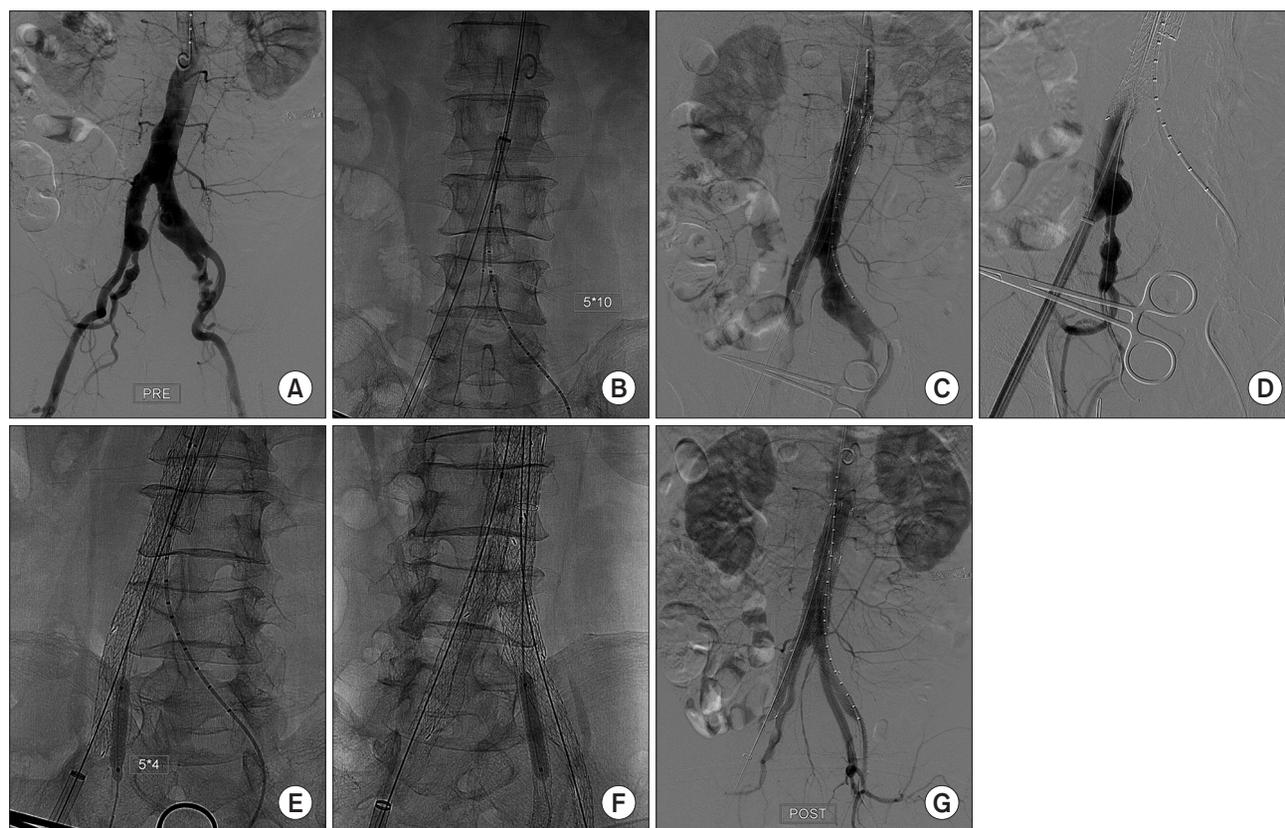
brachial artery along a 180 cm Terumo guidewire (Terumo) into the right subclavian artery under fluoroscopy. An angiogram was obtained after placing a 5-Fr pigtail guiding catheter into the suprarenal artery. Catheterization of the IMA through the right brachial access with a catheter and 0.889 mm 260 cm length Amplatz superstiff wire (Boston Scientific Inc., Natick, MA, USA) was performed. A 5 mm×10 cm-sized Viabahn stent-graft (W.L. Gore & Associates, Flagstaff, AZ, USA) was placed 3 cm inside the IMA with a 7 cm overlap into the abdominal aorta, followed by a 23 mm×14 mm×12 cm-sized Excluder main body stent-graft (W.L. Gore & Associates) inserted through a right femoral approach with positioning of the main body extension 1 cm below the covered stent's proximal end (the main body was deployed first and then the covered stent).

The main body was modeled using a latex balloon and the covered stent was dilated with a 5×4 cm-sized Powerflex PTA (Cordis, Milpitas, CA, USA) angioplasty balloon. Next, a 5-Fr 100 cm-length pigtail was positioned in the supraceliac trunk via the left femoral artery. The right IIA was catheterized through the right brachial access with a 5-Fr 125 cm-length H1 catheter and a 0.889 mm 260 cm length Amplatz superstiff wire. The next step was to place a 8 mm×15 cm-sized covered self-expandable stent 3 cm inside the IIA, overlapping within the right iliac limb by 5 cm. A 16 mm×12 mm×14 cm-sized Excluder iliac limb extension was positioned 1 cm below the covered stent's proximal end; the iliac limb extension was deployed first followed by the covered stent. The next step was to model the iliac limb extension and dilate the covered stent with a 7×4 cm-sized Powerflex P3 PTA angioplasty balloon.

A 16 mm×20 mm×9.5 cm-sized contralateral Excluder iliac limb was deployed through a left femoral approach. The next step was to place a 8 mm×15 cm-sized covered self-expandable stent 3 cm inside the IIA, overlapping within the left contralateral iliac limb by 5 cm. A 16 mm×12 mm×14 cm-sized Excluder iliac limb extension was positioned at the same level as the covered stent's proximal end, unlike the right-side procedure. The final angiography showed exclusion of bilateral CIA aneurysms (CIAAs) and bilateral proximal IIA aneurysms with patent bilateral IIAs and IMA (Fig. 3). Pelvic circulation was well preserved without bowel ischemia at 1 month follow-up CT angiography (Fig. 4).

## DISCUSSION

IAAs usually coexist with abdominal aortic aneurysms (AAAs) (up to 20% of patients with AAA). Isolated IAAs are rare; their prevalence in the general population is estimated to be 0.03%, accounting for 2%–7% of all aortoiliac aneurysms.



**Fig. 3.** (A) Preoperative angiography shows isolated bilateral common iliac artery aneurysms extending bilaterally to the internal iliac arteries (IIAs) and aneurysms on bilateral proximal IIAs. (B) A covered-self expandable stent was placed 3 cm inside the inferior mesenteric artery (IMA) with a 7 cm overlap into the abdominal aorta via a right brachial access, followed by the main body of the stent-graft inserted through a right femoral approach. The main body extension was positioned 1 cm below the covered stent's proximal end. (C) The main body was deployed first and then the covered stent. (D) A covered self-expandable stent was placed 3 cm inside the IIA overlapping within the right iliac limb by 5 cm via a right brachial access, followed by an iliac limb extension positioned 1 cm below the covered stent's proximal end; the iliac limb extension was deployed first followed by the covered stent. (E) Balloon modeling of the iliac limb extension with an angioplasty balloon and dilatation of the covered stent. (F) Using the same method as on the right side, the sandwich technique was performed on the left IIA and left aortoiliac artery. (G) Completion angiography demonstrates exclusion of the aneurysms and preservation of bilateral IIAs and IMA.

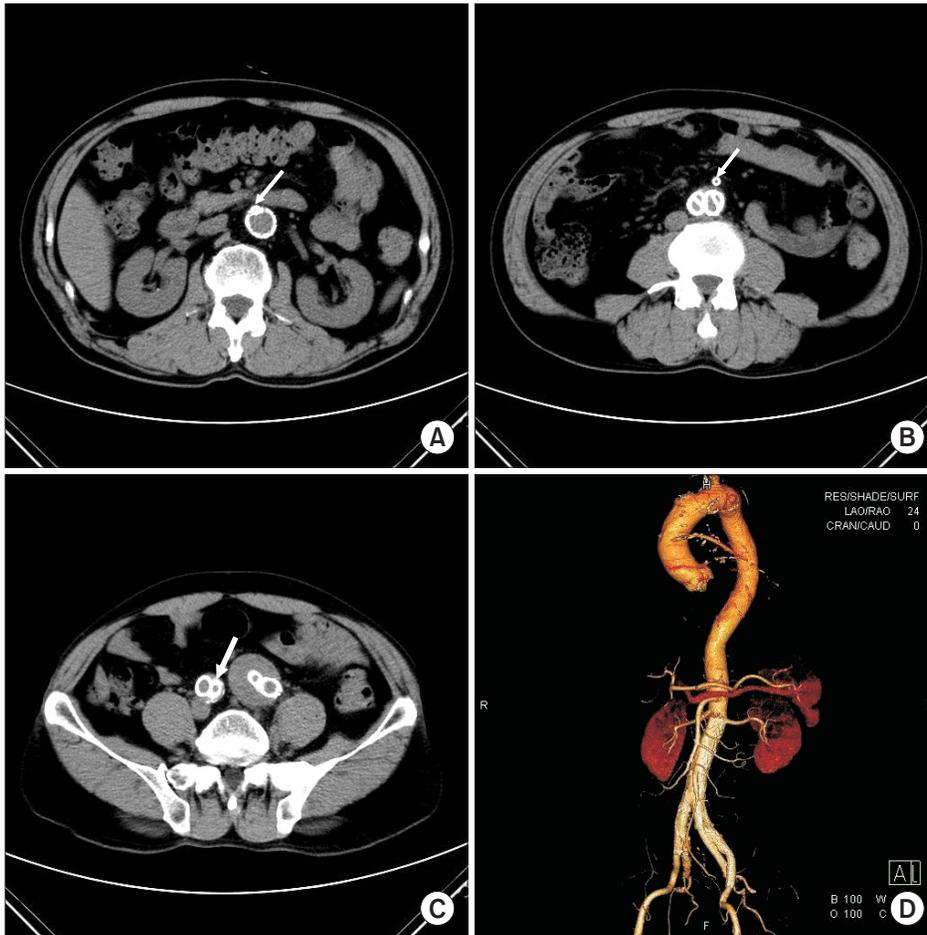
Isolated CIAAs usually progress asymptotically and are revealed incidentally following abdominal imaging. Rupture is a common initial manifestation that also produces substantial mortality [3].

Open reconstruction has been advocated for younger and fitter patients, those with multiple lesions, aneurysms >3 cm in diameter, and aneurysms that produce symptoms or have ruptured. Mortality is higher than with elective AAA repair, ranging between 5% and 11%, whereas the rate ranges from 40% to 50% for an emergency operation. The advent of endovascular AAA repair has offered a minimally invasive alternative to treat isolated CIAAs. Additionally, the technique has evolved substantially and has proven to be an efficacious alternative to open repair, particularly for patients at high surgical risk. Patel et al. [4] reported that

thirty-day mortality rates for patients undergoing elective, emergency open repair and endovascular repair for isolated CIAAs were 6%, 17% and 0%, respectively.

Engelke et al. [5] reported that unilateral IIA convergence might cause benign symptoms with a 25% incidence of buttock claudication, but bilateral IIA occlusion should generally be avoided [3]. Kim et al. [6] reported a rare case of ischemic colitis with bilaterally patent IIAs after endovascular abdominal aneurysm repair.

Huilgol et al. [7] reported using bilateral iliac branch devices for endovascular iliac aneurysm repair. However, there is a lack of experimental data concerning the use of bilateral iliac branch devices, but their benefit can be inferred from what is known about the benefits of IIA preservation and the adverse outcomes of IIA occlusions.



**Fig. 4.** (A-C) Follow-up computed tomography image shows the covered self-expanding stent (thin arrows) running coaxially between the aortic graft and the aortic wall, and covered self-expanding stents overlapping within the ipsilateral and contralateral iliac limbs (thick arrows). (D) Follow-up three-dimensional reconstruction confirms exclusion of the bilateral common iliac artery and bilateral internal iliac arteries (IIAs) aneurysms as well as patency of bilateral IIAs and inferior mesenteric artery at 1 month postoperatively.

The need to preserve IIA flow when performing endovascular iliac aneurysm repair must be assessed on a case-by-case basis. Important factors to consider are spinal cord and bowel perfusion, and functional status of the patient [8].

An appropriate method was chosen for our case of isolated bilateral CIAAs with a prominent IMA by considering pelvic circulation and bowel perfusion. To the best of our knowledge, only one reported case of a deployed covered self-expanding stent preserving the IMA is available [7]. Maldonado et al. [9] reported that 5 of 7 patients with

pelvic ischemia had patent IMA before EVAR. We think preservation of IMA is important to patients with both diseased IIA and prominent IMA. We used a covered stent to preserve the IMA and bilateral IIAs using a sandwich technique. We successfully conducted EVAR with a covered stent. Stentgraft patencies were well preserved without any complications during the follow-up period.

In conclusion, IMA and bilateral IIA preservation with covered self-expanding stents during EVAR is a safe and effective method.

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