

# A hybrid approach to complex bilateral common iliac artery and internal iliac artery aneurysm repair

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## ABSTRACT

A case of a young patient with incidental bilateral internal iliac artery aneurysms and common iliac artery aneurysms is described. A staged hybrid surgical approach was performed to preserve pelvic perfusion, with bilateral stent grafts deployed into an ipsilateral anterior division branch and contralateral posterior division branch of the internal iliac arteries. One week later, an open infrarenal aorto-bi-iliac graft was performed with distal anastomoses to the previously deployed stent grafts. The findings from the present case add to the growing number of reported cases of hybrid repair of bilateral internal iliac and common iliac artery aneurysms with preservation of pelvic perfusion. (J Vasc Surg Cases Innov Tech 2024;10:101410.)

**Keywords:** Common iliac artery aneurysm; Hybrid repair; Internal iliac artery aneurysm

## CASE REPORT

**Clinical presentation.** A healthy 64-year-old man was admitted with incidental asymptomatic bilateral common iliac artery (CIA) aneurysms (CIAAs) and bilateral internal iliac artery (IIA) aneurysms (IIAAs). His family history was significant for infrarenal abdominal aortic aneurysms (AAAs). He provided written informed consent for the report of his case details and imaging studies. A computed tomography angiogram revealed a 3.1-cm AAA, a 7.6-cm right CIAA, and a 2.7-cm left CIAA (Fig 1, A). There were bilateral contiguous IIAAs, measuring 5.6 cm on the right and 5.4 cm on the left, which extended to the anterior and posterior divisions with no distal normal IIA. The patient elected to undergo repair of his complex aortoiliac aneurysms. A hybrid endovascular and open repair was performed in a staged manner (Fig 1, B). The technically difficult open access to the branches of the IIAs and the need for inferior mesenteric artery (IMA) reimplantation informed the decision to perform a hybrid repair instead of an exclusively open or endovascular approach.

**Description of endovascular procedure.** The left IIAA was accessed. A high-flow microcatheter was advanced into the superior gluteal artery (SGA) outflow of the posterior division and embolized. The anterior division was then selected, and a 9-mm by 50-mm Viabahn stent (W.L. Gore & Associates) was deployed at the common origin of the inferior gluteal and internal

pubudendal arteries. This was followed by placement of an overlapping 11-mm by 59-mm Viabahn VBX stent graft (W.L. Gore & Associates), which was landed into the left CIAA sac and expanded via angioplasty to 16 mm at the origin of the IIA. Completion angiography confirmed exclusion of the IIAA, with preserved flow into the anterior division and occlusion of the posterior division.

The procedure was repeated for the right IIAA, in which the internal pudendal and obturator arteries of the anterior division underwent coil embolization. This was followed by placement of a 9-mm by 50-mm Viabahn stent graft (W.L. Gore & Associates) into the proximal SGA and subsequent placement of two overlapping 11-mm by 39-mm Viabahn VBX stent grafts into the right IIAA. These were expanded via angioplasty to 16 mm. However, a type III endoleak was identified, and an additional 11-mm by 79-mm Viabahn VBX stent graft was placed. Completion angiography demonstrated exclusion of the right IIAA, with preserved flow into the SGA and occlusion of the anterior division.

**Description of open aortoiliac aneurysm repair.** Six days after the initial endovascular procedure, the patient underwent open aortoiliac reconstruction. A standard transperitoneal exposure was performed via a midline laparotomy (Fig 2, A). The bilateral external iliac arteries and infrarenal aortic neck were clamped, the aneurysm sac was entered, and direct cannulation of the IIA stents was performed with a 9F balloon. A 22-mm by 11-mm bifurcated graft was sutured to the aortic neck in an end-to-end fashion. The right and left limbs of the aorto-bi-iliac graft were sewn to the bilateral IIA Viabahn VBX stents (Fig 2, B and C). This was followed by translocation of the bilateral external iliac arteries in an end-to-side fashion onto the distal limbs of the bifurcated graft. A ring of Dacron was sutured circumferentially around the distal anastomoses to address needle hole bleeding from the stent polytetrafluoroethylene (PTFE; Fig 2, D). The IMA was reimplanted on the aortic graft as a Carrel patch (Fig 2, E). The retroperitoneum was closed over the repair with the aid of a rotational omental flap, the patient's abdomen was closed, and the patient was

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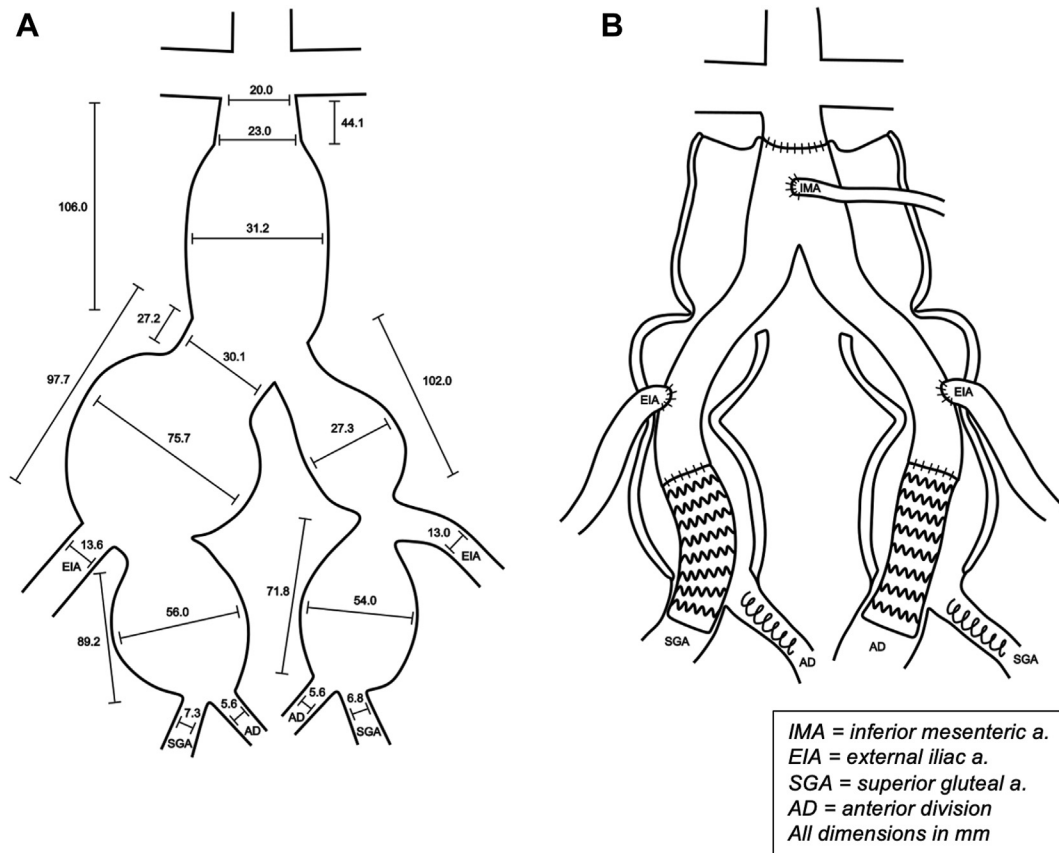
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**Fig 1. A,** Dimensions of complex aortoiliac aneurysms measured with centerline measurements using TeraRecon imaging software. **B,** Simplified diagram of hybrid repair of complex aortoiliac aneurysms. Note other major branches of the posterior division are not visualized for simplicity.

extubated and transferred to the postanesthesia care unit in stable condition.

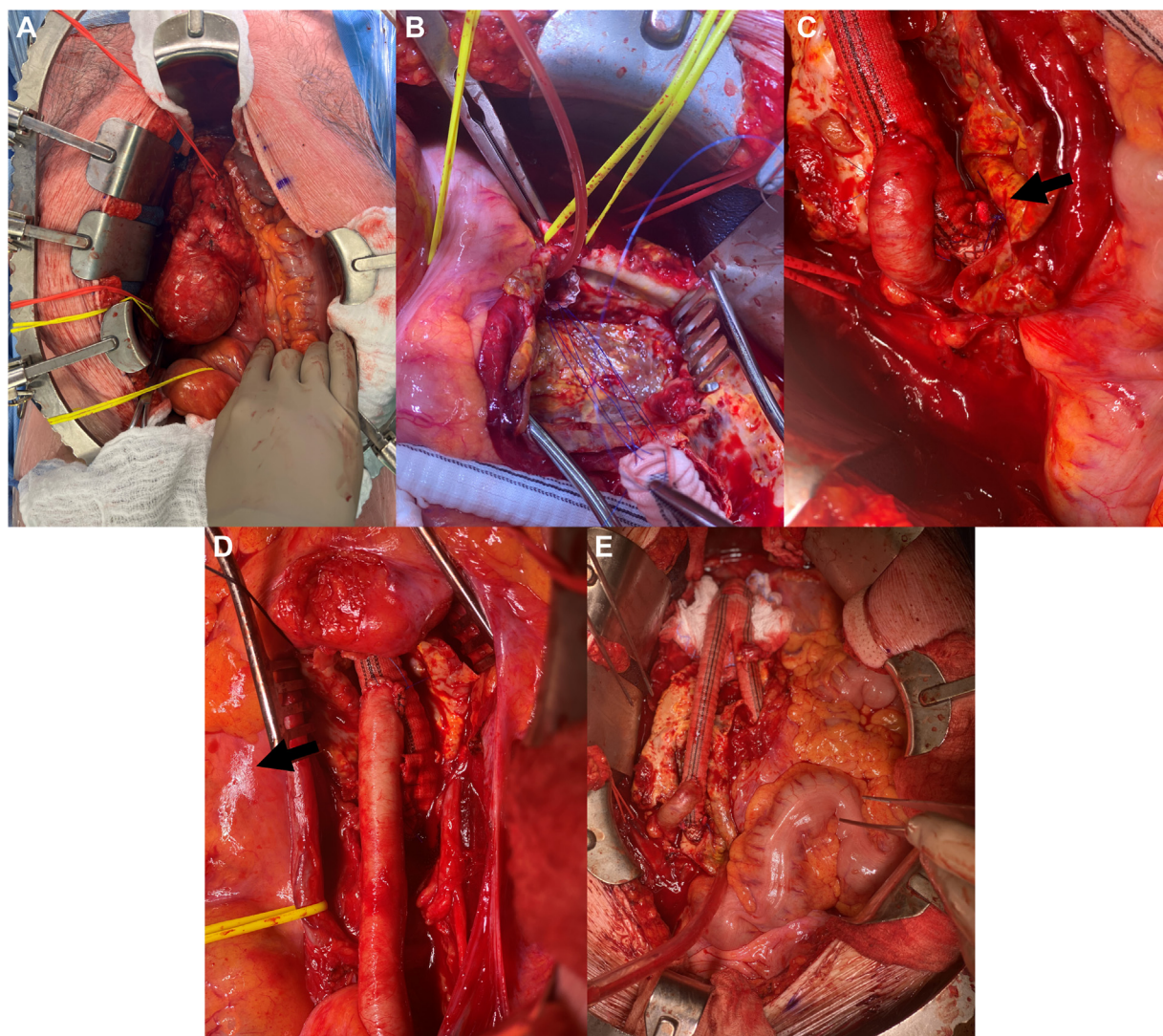
**Postoperative course.** The patient did not develop bowel ischemia, pelvic ischemia, or buttock claudication postoperatively. A final completion computed tomography angiogram performed on postoperative day 8 demonstrated no endoleaks (Fig 3), following which the patient was discharged in stable condition.

## DISCUSSION

Isolated iliac artery aneurysms are rare, with an incidence of 0.03%, and account for 0.4% to 1.9% of all aneurysmal disease.<sup>1</sup> Bilateral isolated IIAAs are even less common, seen in only 25% to 50% of iliac aneurysm cases.<sup>2,3</sup> Although limited literature exists comparing the outcomes of open and complex endovascular repairs of isolated iliac aneurysms, endovascular repair is considered the first-line treatment due to the reduced incidence of perioperative complications and decreased length of stay.<sup>4-6</sup> However, endovascular repair of isolated CIAAs and IIAAs is associated with higher rates of secondary interventions, and the operative approach to bilateral complex CIAAs and IIAAs is influenced by patient factors.<sup>7</sup>

The goal is to minimize the risk of pelvic and bowel ischemia by maintaining antegrade flow in at least one IIA and preserving the IMA.<sup>8</sup> Due to our patient's young age and health, an open repair was preferred for long-term patency. The long-term outcomes and preservation of pelvic perfusion are considered superior with open repair compared with endovascular intervention for IIAAs.<sup>9</sup>

Due to the limitations of achieving distal control of the IIAA outflow in a narrow, deep male pelvis, isolated open repair was not considered. The experience of the senior author is to measure the interischial tuberosity distance at the level of the internal iliac bifurcation. In the present case, the working distance was 10 cm, and, based on the senior author's experience, it was believed that distal control and exposure would be challenging. A purely endovascular approach was complicated by the patient's bilateral IIAAs. Endovascular repair of a unilateral IIAA via embolization and stent graft implantation is an effective approach in patients with adequate collateralization.<sup>10-12</sup> However, this approach applied to bilateral IIAA disease in the setting of bilateral CIAA disease requires concurrent IMA coverage and places the patient at increased risk of pelvic and colonic ischemia.<sup>13</sup> Bilateral IIAA



**Fig 2.** **A**, Open exposure of infrarenal aorta, large right common iliac aneurysm to iliac bifurcation, and proximal left common iliac artery. **B**, Right aortoiliac graft to right internal iliac artery (IIA) stent anastomosis. **C**, Completion of right aortoiliac graft to right IIA stent anastomosis with translocation of right external iliac artery onto the graft. **D**, Dacron ring secured around graft to stent anastomosis to reduce needle-hole bleeding from stent polytetrafluoroethylene (PTFE). **E**, Completion of infrarenal aorto-bi-internal iliac graft repair with reimplantation of bilateral external iliac artery and inferior mesenteric artery (IMA).

embolization is associated with rates of buttock claudication of  $\leq 30\%$  and erectile dysfunction of  $\leq 17\%$ . Pelvic and colonic ischemia were rare complications in a recent meta-analysis but were twice as likely to occur in patients with bilateral IIA occlusion.<sup>14</sup>

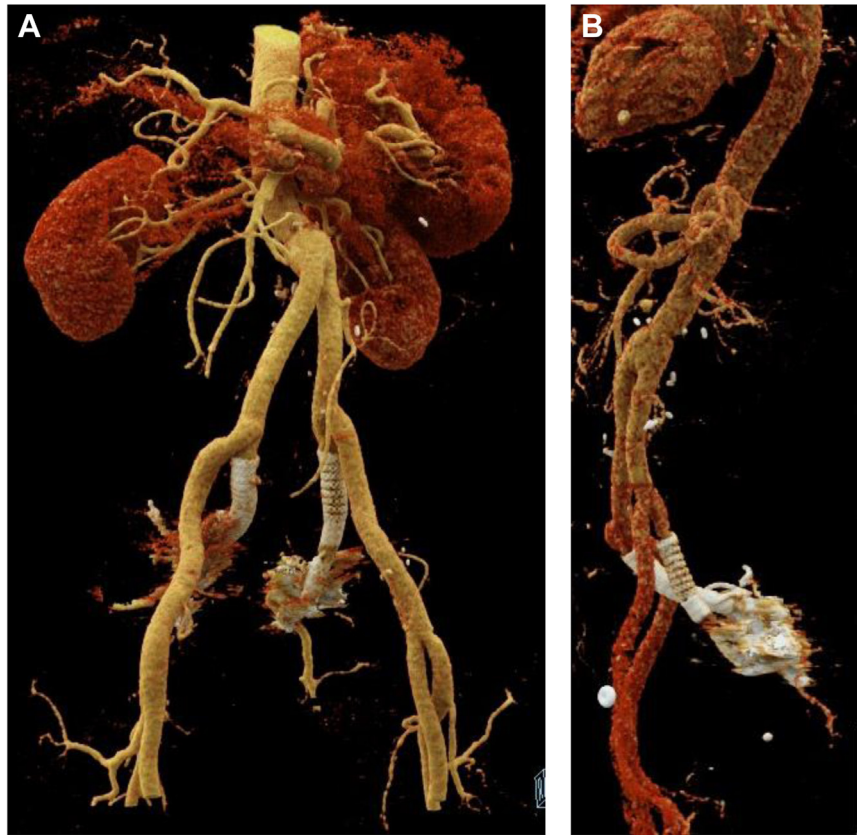
Although branched graft technology is increasingly available for CIAAs, the treatment of IIAAs is not within the instructions for use.<sup>15</sup> However, branched grafts have been applied off-label in the treatment of isolated IIAAs with a distal landing zone in the posterior division.<sup>16</sup> Good technical success has been reported; however, the long-term patency is unknown.

Hybrid interventions for aortoiliac aneurysms have been described in the setting of concurrent occlusive disease.

Krzyzaniak et al<sup>17</sup> discussed a successful hybrid approach to AAA repair in the setting of severe CIA calcification, in which intraoperative CIA stents were placed, and distal graft-to-stent anastomoses were performed. Graft-to-stent anastomoses in the setting of isolated CIAA and IIAA repair were also discussed in a recent case series, in which a unilateral self-expanding stent was placed in the SGA, followed by an end-to-side stent-graft anastomosis to the aorto-bi-iliac graft during the open repair stage.<sup>18</sup>

The novel approach in the present case involved preservation of one anterior division of the ipsilateral IIA and contralateral posterior division via the dominant SGA of the IIA in a staged endovascular manner. It involved





**Fig 3.** Three-dimensional reconstruction of computed tomography angiogram of the patient's aortoiliac system postoperatively from the anterior (A) and lateral (B) views.

deployment of bilateral stent grafts without proximal fixation initially, followed by a direct anastomosis between the aorto-bi-iliac graft and iliac stents. The staged open approach allowed for IMA reimplantation to further reduce the risk of postoperative bowel ischemia. Although no robust evidence is available to guide the duration of staging, the urgency of repair was balanced by the risk of pelvic ischemia after the endovascular stage. The delay was loosely determined by the practice of delaying bilateral IIA embolization to ensure no pelvic ischemia is present and to allow some pelvic collateralization to occur. After 72 hours without complications, the patient was scheduled for the next available operating room time.

Although balloon-expandable stents were chosen for the endovascular stage to achieve a large postdilation diameter within the proximal IIAA, this necessitated the use of iliac occluding balloons for distal control, instead of primary clamping. Also, the single-layer PTFE was subject to significant needle-hole bleeding that required reinforcement with an additional Dacron ring. Therefore, depending on the clinical situation, the use of self-expanding covered stents alone or a stent with dual-layer PTFE to avoid needle-hole bleeding could be advantageous.

## CONCLUSIONS

This report demonstrates a successful staged hybrid repair of bilateral CIAAs and IIAAs using graft-to-stent anastomoses to preserve pelvic perfusion in complex aortoiliac aneurysmal disease.

## DISCLOSURES

None.

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