

Endovascular Management of Common and Internal Iliac Artery Aneurysms

How iliac branch grafting may become a first-line treatment option.

BY ERIN H. MURPHY, MD, AND EDWARD Y. WOO, MD

Isolated common iliac artery (CIA) and internal iliac artery (IIA) aneurysms are relatively uncommon, occurring in only 0.03% of the population and constituting < 2% and 0.4% of clinically noted aneurysmal disease, respectively. In the presence of an abdominal aortic aneurysm (AAA), however, aneurysmal iliac arteries are significantly more common, accompanying this disease in up to 40% of patients. In this patient subset, the incidence of multiple iliac aneurysms also increases dramatically, such that the majority of patients with AAA and a CIA aneurysm will have bilateral CIA aneurysms. In patients without AAAs who have an isolated CIA aneurysm, 25% will still have bilateral disease. These associations are most likely the result of a shared underlying pathophysiology, namely, degenerative atherosclerotic disease, which also explains the predilection of this disease for the elderly.

Most CIA and IIA aneurysms are clinically asymptomatic and elusive to physical examination, given their location deep in the pelvis. These aneurysms are frequently discovered incidentally. Less commonly, patients present with complications of local compression, such as hydronephrosis or deep venous thrombosis, pain from rapid growth, or rupture.

INDICATIONS FOR INTERVENTION

Certainly, the avoidance of complications, namely rupture, is the main motivation for treatment. The risk of rupture is determined both by growth rate and aneurysm size. Although the CIA is technically considered aneurysmal when reaching a diameter of 1.5 cm, the average size of ruptured CIA aneurysms is approximately 7 to 8 cm.¹ Most importantly, ruptures in aneurysms smaller than 3.5 cm are exceedingly rare. Thus, it is generally agreed that aneurysms under 3 cm can be safely observed, with small variations in the recommended size threshold to consider repair in aneurysms ranging in size from 3 to 4 cm.

The rate of aneurysm growth has been more difficult to define. Santili et al demonstrated that small aneurysms (< 3 cm) expand at a slower rate, averaging 1.1 mm/year,² whereas the growth rate of aneurysms larger than 3 cm increased more rapidly, at an average rate of 2.6 mm/year. Notably, however, one-third of the aneurysms in this series showed no expansion, with a mean follow-up of more than 30 months.² Other authors have demonstrated results ranging from no growth in aneurysms 2 to 2.5 cm in size at up to 50 months of follow-up³ to an average expansion rate of 2.9 mm/year regardless of size.⁴ This unpredictable nature of

aneurysm growth requires a flexible and individualized treatment approach for each patient.

The management of IIA aneurysms has not been as well defined due to the relative rarity of this pathology. Nonetheless, our current understanding of the natural history portends growth and eventual rupture. Recommendations generally follow the size criteria of CIA aneurysms, and repair is recommended after reaching 3 to 3.5 cm in size.

ENDOVASCULAR MANAGEMENT

Open surgical techniques for repair of CIA and IIA aneurysms, although usually straightforward, can be complicated by difficult exposures, blood loss, morbidity, and mortality. Similar to many endovascular interventions, endovascular management of CIA and IIA aneurysms has been associated with decreases in morbidity, 30-day mortality, blood loss, and hospital stay as compared to traditional open operations without sacrificing mid-term durability or survival.^{4,5} Endovascular treatment is therefore offered as the first-line therapy for aneurysmal iliac disease at many institutions, including our own.

These techniques are indicated when the patient's anatomy is suitable and compressive symptoms are absent. In general, the presence of compressive symptoms lends to open repair because an endovascular approach will not lead to immediate decompression. In patients at prohibitively increased operative risk with compressive symptoms, endovascular techniques for disease exclusion combined with ureteral or iliac vein stenting may prove sufficient as the aneurysm sac remodels and the immediate arterial pressure is removed. Nonetheless, this option is not ideal because endovascular exclusion has not been associated with predictable changes in aneurysm morphology or decreases in size.

Preoperative planning is essential to determine the manner of approach to these interventions. We use computed tomographic angiography with three-dimensional reformatting. Imaging is reviewed for the presence of coincident aortic or contralateral iliac aneurysms and to ensure the suitability of the proximal and distal endograft landing zones, including the relationship of the aneurysmal disease to the origin of the IIA. At the time of intervention, angiography with or without the addition of intravascular ultrasound may be used to confirm preoperative measurements.

CIA Aneurysms

If the disease is confined to the CIA with adequate proximal and distal landing zones, treatment with a

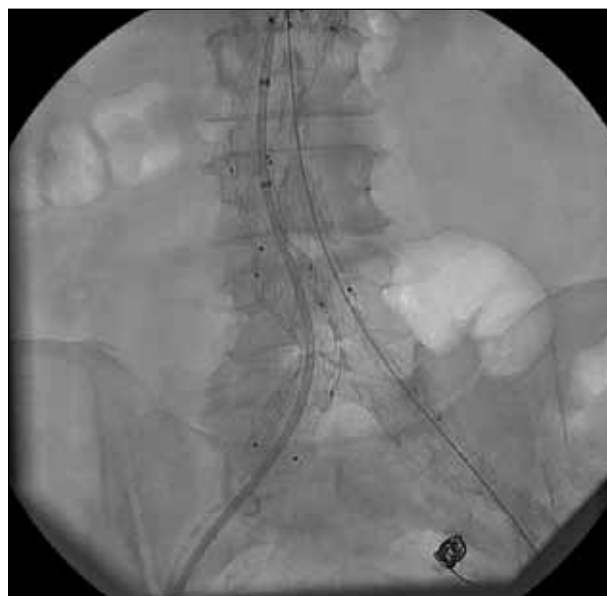


Figure 1. Coil embolization of the IIA from brachial access performed before stent graft coverage of this vessel's orifice by an endograft limb extended into the left external iliac artery (EIA) to treat a left CIA.

covered stent or endograft limb for disease exclusion is appropriate. If the aneurysmal disease involves either the abdominal aorta or the proximal iliac arteries without an adequate seal zone, the preferred endovascular approach is that of standard endovascular aneurysm repair (EVAR) with a bifurcated endograft.

The distal landing zone is determined relative to the hypogastric artery. It is preferable to preserve the IIA whenever feasible. Loss of the IIA can lead to buttock claudication and sexual dysfunction.⁶ In rare instances, loss of IIA blood flow can lead to disastrous consequences, such as gluteal necrosis, spinal cord ischemia, and colonic infarction.⁷⁻¹⁰ Symptoms may be exacerbated if a patent inferior mesenteric artery is also sacrificed, as is standard during EVAR. Although unilateral IIA sacrifice is generally tolerable by most, up to 45% of patients will complain of some buttock claudication.⁴

It is true that some of these patients improve with time, but this is not universal. In one series, only two of 31 patients (6%) with new-onset unilateral buttock claudication after unilateral hypogastric artery coiling showed improvement in claudication at 6 months.¹¹ Other investigators have documented improvement in all patients but with none returning to preoperative baseline activity levels.¹² In the right patient, such a result may be considered a reasonable trade-off to provide an endovascular solution, but very active younger patients may not accept this compromise as a tolerable

result. Thus, attempts to preserve one or both hypogastric arteries may be preferable in some patients, particularly when noting that retroactive treatment options are limited should debilitating symptoms develop postoperatively.

Current endograft technology allows treatment of iliac aneurysms with a landing zone diameter of up to 25 mm at the bifurcation. This can be accomplished with the use of large-diameter or flared endograft limbs.¹³ The largest limb available is 28 mm, offered by the Endurant endograft (Medtronic, Inc., Minneapolis, MN). When the diameter of the seal zone at the level of the hypogastric origin exceeds 25 mm or the aneurysmal segment extends past the iliac bifurcation, the endograft can be extended into the EIA. This requires that the proximal IIA be occluded either by coil embolization (Figure 1) or by use of a vascular plug (Amplatzer vascular plugs, St. Jude Medical, Inc., St. Paul, MN), thus preventing a type II endoleak. If the IIA is not aneurysmal, it should be preferentially occluded at the most proximal location possible because preservation of more distal hypogastric branches has been associated with decreased rates of claudication postoperatively.¹⁴

In circumstances in which preservation of the IIA is preferred (contralateral occlusion, large inferior mesenteric artery, concomitant thoracic endograft), a unilateral external-to-internal artery bypass can be safely used to preserve pelvic blood flow (Figure 2). During the bypass, it is important to ensure that the proximal IIA is ligated to prevent a future type II endoleak. Also, the bypass should originate from the distal EIA to allow landing of the endograft limb in the EIA.

Multiple studies have demonstrated success with external-to-internal artery bypass, including excellent mid- and long-term patency rates.¹¹ Nonetheless, many advantages of performing a noninvasive procedure are lost as a retroperitoneal exposure is required to construct the bypass. Operative times and hospital stays are extended while intraoperative blood loss is increased.⁴

An alternative hybrid technique involves the use of an aortounilateral endograft with a femoral-femoral crossover bypass. A flexible covered stent can then be deployed from the contralateral EIA into the IIA artery, creating an endovascular external-to-internal iliac artery bypass. This allows retrograde perfusion and simultaneously excludes the contralateral CIA.^{15,16} The obvious advantage of this technique is the elimination of retroperitoneal exposure. The disadvantage is that it still requires a femoral-femoral bypass.

The technical downsides of hybrid procedures lend motivation to the development of total endovascular techniques for hypogastric preservation. Creative endograft construc-



Figure 2. Internal-to-external iliac artery bypass. A patient with an aortic aneurysm and accompanying bilateral CIAs. Preoperative imaging identified occluded left and patent right IIAs. A right external-to-internal iliac bypass was performed and the proximal right IIA was ligated prior to EVAR. EVAR was then performed extending the distal grafts into the proximal EIAs bilaterally to exclude the bilateral CIA aneurysms. The patient recovered well without symptoms of claudication or sexual dysfunction postoperatively.

tions have been reported. One such strategy involves the use of the dual-main body Excluder endoprosthesis (Gore & Associates, Flagstaff, AZ) to create a trifurcated endograft. On the side opposite the iliac aneurysm, a contralateral limb extension is deployed in the standard fashion. On the side ipsilateral to the CIA aneurysm, a second main body is deployed in the ipsilateral leg of the first main body. One limb is then extended to land in the EIA and the other in the IIA, resulting in aneurysm exclusion with IIA preservation. This technique was successfully reported in five patients with 100% technical success. Axillary access was required for delivery of the hypogastric extension.¹⁷

A more common strategy for endovascular bypass, however, is the “sandwich technique” in which the ipsilateral iliac limb extender is deployed into the EIA alongside a Viabahn stent graft (Gore & Associates), which is distally deployed into the hypogastric artery. Proximally, the two stent grafts lie side-by-side within the ipsilateral limb of the main endograft body.^{18,19} Lastly, because commercialized iliac branch devices are not yet available outside of trial in the United States, some describe the use of surgeon-modified branch grafts to achieve similar endpoints.²⁰ However, it is expected that once approved, commercial iliac branch devices will supplant the physician-modified devices.

Currently, Cook Medical’s iliac branched device (Cook Medical, Bloomington, IN) is in trial in the United States and has already been used with success outside the United States.²¹⁻²⁷ In several series with similar devices based on the Cook platform, successful exclusion of aortoiliac aneurysms with preservation of at least one hypogastric artery was performed in more than 85% of cases with low perioperative morbidity and mortality rates. Furthermore, only one type III endoleak was reported.²¹⁻²⁴ In fact, when compared to hypogastric exclusion with coil embolization, iliac branched devices were employed with similar morbidity and mortality while significantly reducing the occurrence of symptoms attributable to pelvic ischemia.²⁵

We have had a similar experience thus far with this graft at our institution, with 100% procedural success and hospital stays equivalent to standard EVAR (Figure 3). Observed mid-term durability outside the United States is encouraging, with follow-up out to 60 months indicating a cumulative patency of 87% to 91.4%.^{26,27} Freedom from secondary intervention was 90% at 1 year and 81.4% at 5 years in one series of 100 consecutive procedures.²⁷

IIA Aneurysms

The ability to preserve IIA flow is greatly reduced in the setting of IIA aneurysms. Open procedures are generally less favored because these aneurysms extend deep into the pelvis. IIA aneurysms are most often treated by endovascular coil embolization of the distal branches, the aneurysm itself, or a combination thereof. Occasionally, a vascular plug has also been used for occlusion. The IIA orifice is then typically excluded with use of a covered stent graft. Attempts to preserve flow by endovascular exclusion are anatomically challenging because the proximal and distal landing zones are often inadequate. Success is possible if there is a proximal and distal landing zone within the IIA. Alternatively, if there is no distal landing zone, the IIA stent can be landed distally in the largest IIA branch after coil embolization of any smaller branches contributing to the aneurysm sac. If there is no proximal

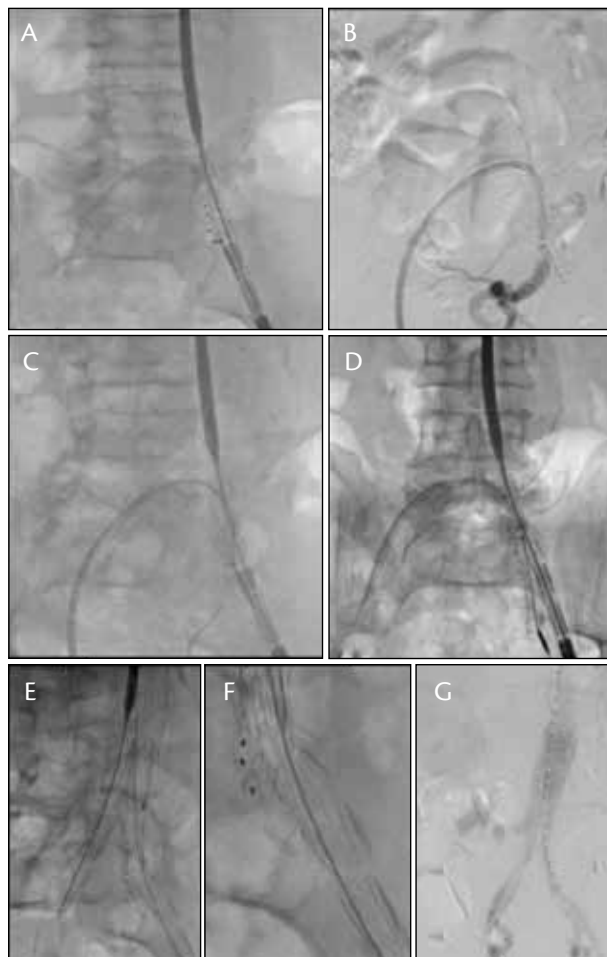


Figure 3. Iliac branched device (Cook Medical) deployment. A partially deployed iliac branched device with the branch directed toward the IIA (A). Angiogram showing the hypogastric artery is shown (B). A wire is advanced into a branch of the hypogastric artery (C). A covered stent is delivered into the hypogastric artery (D). The external and internal iliac stents are completely deployed (E). A close-up of the stented internal-external bifurcation (F). Completion angiogram after EVAR and left iliac branch grafting (G).

landing zone, a chimney/snorkel procedure can be used with a proximal landing zone in the CIA or EIA.

CONCLUSION

It is our experience that the majority of CIA and IIA disease may be treated with endovascular techniques, thus resulting in shorter hospital stays and decreased morbidity and mortality rates compared to open repair. Preservation of one or both hypogastric arteries during endovascular repair can be accomplished through various techniques. As experience with iliac branch grafting continues to grow, it will likely become a first-line endovascular treatment option. ■

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