

Inverted Ovation iX Limb to Treat an Isolated Common Iliac Artery Aneurysm

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In recent years, endovascular aneurysm repair has become the predominant method of managing abdominal aortic and common iliac artery aneurysms. Off-label use of different endovascular devices has allowed them to remain a viable option in many cases of atypical anatomy. Some studies have reported the use of iliac devices in an upside-down configuration when the common iliac artery aneurysm has a reverse-tapered morphology. However, the use of the Ovation iX (Endologix) limb in an upside-down configuration has not yet been reported. This limb offers a 14 mm distal end when inverted and offers good patency in the tortuous iliac morphology. This case report describes and illustrates the precise deployment of an inverted Ovation iX limb to treat an isolated common iliac artery aneurysm.

Key Words: Endovascular procedures, Iliac aneurysm, Ovation iX, Inverted iliac limb

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INTRODUCTION

In recent years, endovascular aneurysm repair has become the predominant method of managing abdominal aortic and common iliac artery (CIA) aneurysms. Off-label use of different endovascular devices has allowed them to remain a viable option in many cases of atypical anatomy. In addition, some studies have reported the use of iliac devices in an upside-down configuration when the CIA aneurysm has a reverse-tapered morphology [1-5]. The use of the Ovation iX graft in the inverted configuration provides a new solution to achieve proper sealing in a reverse-tapered iliac artery aneurysm with a 14 mm distal diameter when inverted. Since there is no description in the literature of an inverted Ovation iX limb, we decided to report this case to explain how we achieved precise deployment.

Institutional Review Board exemption provided by the institution since there are less than 5 participants in the study.

CASE

An 80-year-old male was referred for an asymptomatic 44 mm right CIA aneurysm (Fig. 1). His medical history was relevant only for hypertension.

Computed tomographic angiography revealed a normal infrarenal aorta. The right CIA measured 17-18 mm in diameter over the first 2 cm. The fusiform aneurysm extended into the iliac bifurcation. The external iliac artery (EIA) and internal iliac artery (IIA) were generous with minimal atherosclerosis but with some tortuosity. The EIA had a diameter of 12 mm. With respect to the instructions for use, the aortoiliac anatomy was suitable for an iliac branch device combined with an infrarenal aortic bifurcated graft. However, considering his age and minimal daily walking distance, the patient was planned to receive percutaneous endovascular treatment with embolization of the right IIA and deployment of a single inverted Ovation iX iliac limb (Endologix).

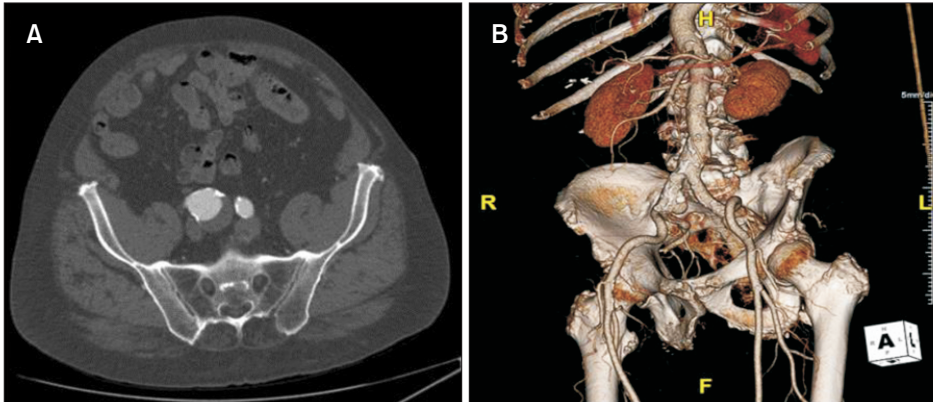


Fig. 1. Isolated right common iliac aneurysm (A) CT axial section and (B) 3D-reconstruction.

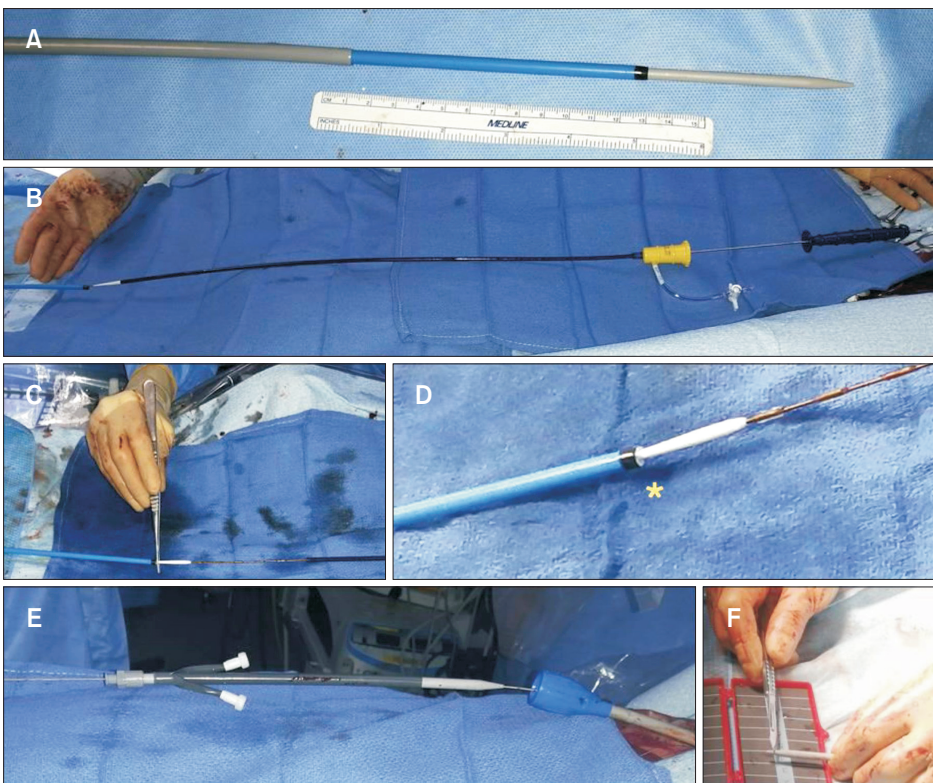


Fig. 2. (A) 14F×45 cm introducer sheath inside an 18F×28 cm sheath. (B) Ovation iX device being introduced on a wire into the 14F sheath. (C) DeBakey forceps used to maintain Ovation iX graft in place while retrieving the delivery system. (D) Visible endograft with the sheath tip (marked by asterisk). (E) 18F peel away inserted into the 18F introducer sheath to allow insertion of the 14F sheath without its dilator. (F) 14F dilator being cut to create a blunt tip pusher.

The patient underwent surgery under regional anesthesia. Ultrasound-guided puncture of the bilateral common femoral arteries was performed. We started right IIA embolization with a 14 mm endovascular Amplatzer plug (Abbott Cardiovascular Inc.) via a contralateral approach. We then prepared an inverted Ovation iX TV-IL1422100-1 limb (14×22×100 mm, 12F) for right transfemoral coaxial insertion. The plan was to execute back-table deployment of this limb into a 14F sheath, positioning the 22 mm diameter portion of the endograft flush to the tip of the 14F sheath.

To achieve this, the Ovation iX limb was advanced 12 cm (including the nose cone) into a 14F×45 cm sheath from the tip of the sheath to the hemostatic valve direction with the support of an Amplatzer guidewire. We then carefully un-

sheathed and deployed the endograft, ensuring that it remained in the sheath using DeBakey forceps while removing the deployment system (Fig. 2A-D). A catheter was placed on the guidewire through the 14F sheath, allowing the wire to be removed. The inverted endograft and its preloaded catheter were then ready for use.

A right transfemoral 28 cm long 18F sheath was advanced on a Lunderquist wire up to the origin of the right CIA (Fig. 3A-C). An 18F peel-away catheter with a dilator was inserted along the sheath (Fig. 2E). After removing the peel-away dilator, a 14F sheath containing the inverted limb was inserted along the Lunderquist wire, and the preloaded catheter was removed. It was then inserted into the 18F sheath using a peel-away, and both sheath tips were

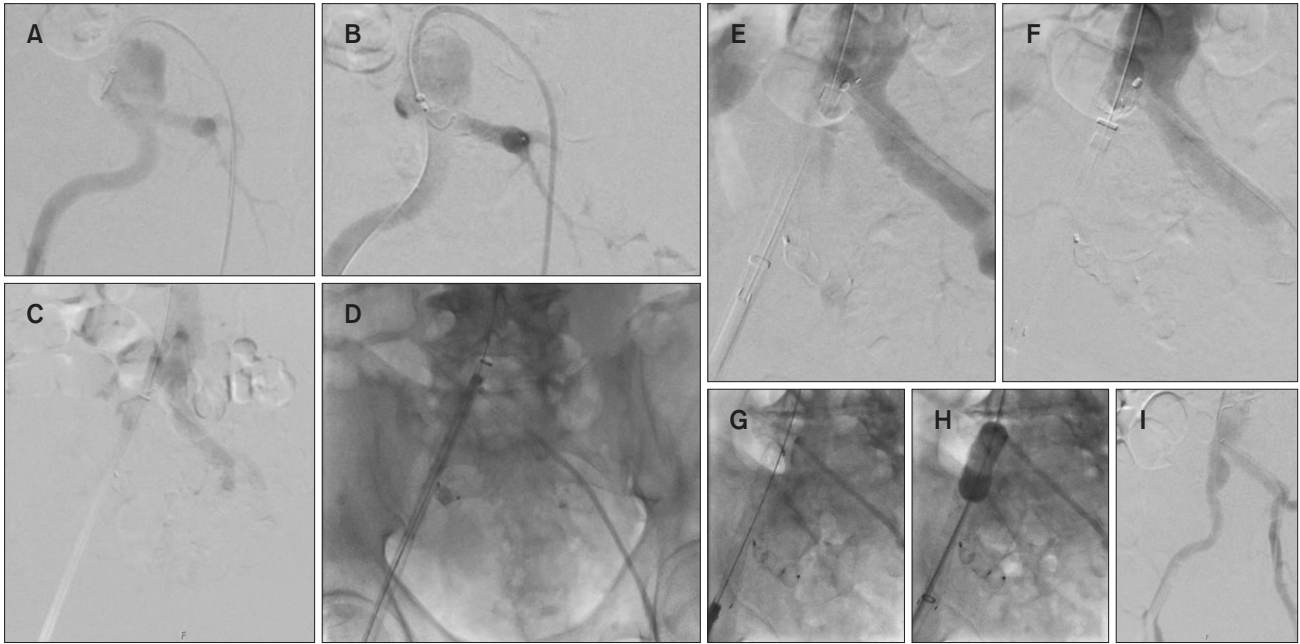


Fig. 3. Intraoperative fluoroscopic image. (A-C) The introduction of a 28 cm long 18F sheath into the right common iliac artery. (D) The insertion of the 45 cm long 14F sheath using the peel-away showing both sheath tips matched at the same level. (E) The deployment of the first centimeter of the stent high into the aorta. (F) Advancing the 18F sheath to partially swallow back the deployed part of the endograft. (G-I) The completion of the deployment of the endograft demonstrating successful perfusion.



Fig. 4. Close up picture of the deployment system. Beads seen offer better control during deployment.

matched at the same level under fluoroscopy (Fig. 3D).

Thereafter, we cut the dilator of the 14F sheath close to its tapering top (Fig. 2F) and used it as a pusher by bringing it close to the distal end of the inverted limb under fluoroscopic guidance. The 18F sheath was retracted while pushing the dilator of the 14F sheath maintaining it in place. The first centimeter of Ovation iX was deployed under fluoroscopy. Despite the presence of a contralateral 8F catheter and a fusion landmark, an angiogram was useful at this point to show that the first centimeter of the stent was deployed too high into the aorta (Fig. 3E). Normally, this is avoided using radiopaque markers on the main body. Keeping the 14F sheath within the 18F sheath during deployment allowed us to use the 14F sheath as a pusher, which provided a stable platform for precise control over stent graft deployment. By deploying the first centimeter of the graft, we maintained a greater degree of control over the procedure, reducing the likelihood of misplacement due to accidental deployment of more stent grafts than intend-

ed. Advancing the 18F sheath helped partially swallow the deployed part of the endograft (Fig. 3F-I).

The rest of the deployment was performed by retrieving both the 18F and 14F sheaths while holding the pusher in place. A Coda balloon was used to ensure good apposition of the stent in the proximal and distal landing zones. Final angiography revealed the absence of an endoleak. Percutaneous closure of the femoral access sites was performed without complications, and the patient was discharged the following day.

DISCUSSION

Several options exist for the treatment of isolated CIA aneurysms. Open repair, chosen selectively, offers advantages such as the preservation of the EIA and IIA, ensuring long-term patency, and relieving compression syndrome in the case of a large IIA aneurysm. For older or frail patients with a CIA aneurysm measuring >40 mm, an endovascular

approach may be preferred. This approach can be executed with or without preservation of the IIA. The decision to preserve the IIA depends mainly on the estimated risk of embolization and its impact on the patient's quality of life. The status of the contralateral IIA, as well as the superior mesenteric artery (SMA) and inferior mesenteric artery (IMA) arteries, should be assessed. Preservation of the IIA may be preferable when the EIA is small or diseased. Buttock claudication is a well-known complication of IIA embolization. With regard to our patient's condition, we decided to embolize this vessel because he was not physically active and the SMA, IMA, and contralateral IIA were generous, with no atherosclerosis.

Conventional bifurcated endovascular aneurysm repair is a simple method of treating CIA aneurysm. However, our patient had both a low accessory renal artery and a patent IMA. Therefore, we chose another option.

When the proximal CIA provides a good seal zone, the deployment of an inverted iliac endograft is a well-known technique for treating elective or urgent CIA or IIA aneurysms. The use of an off-the-shelf endograft with a large diameter at one end and a small diameter at the other is useful in most cases.

Different options for reverse endograft deployment in the iliac axis have been proposed. This includes techniques without backtable device deployment [1], backtable deployment inside another sheath, and deployment followed by inverted endograft resheathing using the same delivery device [2-5]. Using a Gore excluder limb (W.L. Gore & Associates), Van Der Steenhoven et al. [1] described the reversal of a contained graft over its own delivery system without deployment. They inserted the modified device into an 18F sheath and deployed it using a pulling Gore system. Their technique reduced the risk of damage or twisting of the limb because it had not been deployed on the backtable. Leon and Mills [3] also described a case of a CIA aneurysm

treated with a reversed Zenith iliac limb (Cook Medical) by preliminary extracorporeal predeployment, endograft reversal, and reinsertion into the delivery sheath.

Despite extensive review, we found no documentation in the literature regarding the off-label use of an inverted Ovation iX endograft. Notably, the Ovation iX distinguishes itself by offering a 14 mm distal end when inverted and demonstrated good patency in patients with tortuous iliac morphology [6]. While this device can be inserted into a 12F sheath, deploying it inverted into a 12F sheath might not allow the retrieval of its deployment system. Additionally, the technique we describe differs by the addition of a guidewire to provide additional options in case of inaccurate deployment. Nonetheless, we recommend careful initial endograft deployment at the CIA ostium.

The removal of the deployment system (Fig. 4) reduces the precision during deployment. Utilizing a larger coaxial sheath could enhance control and facilitate the repositioning of the proximal end of the endograft, while protecting the iliac artery during sheath insertion without a dilator.

The proximal and distal diameters of the iliac limb varied between 12 to 16 mm and from 9 to 28 mm, respectively (Table 1). The choice of the best endograft should be tailored to each patient, depending on the sealing zone diameter and tortuosity. Alternative options include the adaptation of existing endografts into physician-modified grafts, which may involve procedures such as bare-stent removal from a converter [7].

Finally, it is also possible to deploy an iliac limb without inversion through a contralateral approach with a through-and-through wire or via an axillary approach if the sheath is long enough; however, this method offers less precision for the deployment of the distal portion of the endograft, as it is deployed last. If the device deployment is too low, the addition of a short iliac extension through an ipsilateral transfemoral approach could then provide the required

Table 1. Off-the-shelf endograft options for iliac aneurysm treatment

	Proximal diameter (mm)	Distal diameter (mm)	Length (mm)
Gore (W.L. Gore & Associates)			
Excluder Iliac limb	16	12, 14.5, 16, 18, 20, 23, 27	100, 120, 140
Medtronic (Medtronic Inc.)			
Endurant limb	16	10, 13, 16, 20, 24, 28	82, 93, 124, 256, 199
Cook (Cook Medical)			
Converter alpha ZLC	24, 28, 32, 36	12	66
Spiral Z alpha ZISL	12	9, 11, 13, 16, 20, 24	70, 87, 106, 121
Converter Flex ESC	24, 28, 32, 36	12	80
Spiral Z ZSLE	13	9, 11, 13, 16, 20, 24	61, 78, 96, 112, 129
Endologix (Endologix)			
Ovation iX	14	10, 12, 14, 16, 18, 22, 28	80, 100, 120, 140, 160

proximal sealing.

In summary, the Ovation iX limb can be easily inverted to allow treatment of selected patients with CIA or IIA aneurysms.

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CONFLICTS OF INTEREST

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AUTHOR CONTRIBUTIONS

Concept and design: PC, SE. Analysis and interpretation: PC, SE. Data collection: PC, SE. Writing the article: all authors. Critical revision of the article: all authors. Final approval of the article: all authors. Statistical analysis: none. Obtained funding: none. Overall responsibility: SE.

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