Unique operative approach for dealing with a tortuous external iliac artery during abdominal aortic aneurysm endografting

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Endovascular repair of abdominal aortic aneurysms offers many benefits over open repair. However, there are many characteristics that can exclude patients from undergoing this minimally invasive procedure, such as iliac arterial pathology. The present report describes the case of an 85-year-old patient with an aneurysm in

which the right external iliac artery presented a challenge for vascular access due to its severe tortuosity and hairpin turn. Access for endovascular repair was achieved via an end-to-end anastomosis of the external iliac artery through a transverse inguinal incision. This represents a new option for achieving endograft placement when confronted with vascular tortuosity.

Key Words: Abdominal aortic aneurysm; Endograft placement; External iliac artery tortuosity

Controlling access during abdominal aortic endografting is often a limiting factor for endograft treatment of abdominal aortic aneurysms (AAAs). In addition, patients with difficult access are often at high risk for major morbidity and mortality related to attempts at access and device placement. At times, simple stiff wire placement allows easier access and permits endograft placement; some patients may require dilation for calcified lesions. Although an aortouniliac reconstruction with a femoral-femoral bypass is an option, it would require an additional bypass with its inherent risks, such as infection and graft occlusion (ie, 50% to 60% patency rates for bypass). The present report describes a case in which resection and end-to-end anastomosis of the external iliac artery through a transverse inguinal incision allowed access for endograft placement and treatment of an AAA.

CASE PRESENTATION

An 85-year-old man presented with a 6.5 cm AAA and a 4.1 cm right iliac aneurysm. The patient's AAA had a 33 mm neck requiring endograft placement with a Zenith aortic endograft (Cook Medical Inc, USA). A limiting factor for endograft placement was related to access via the right external iliac artery and its severe tortuosity with a hairpin turn (Figure 1). The initial computed tomography scan of the abdomen and pelvis revealed no significant calcification within the right external iliac system.

During the procedure, a Glidewire (Boston Scientific, USA) was advanced through the tortuosity and a Berenstein catheter (Boston Scientific) was advanced through the lesion in exchange for an Amplatz stiff wire (Boston Scientific). However, once the stiff wire was placed, there was no blood flow through the external iliac artery due to severe kinking of the artery after wire placement (Figure 2). There were several attempts to pass devices through the tortuosity, which were all unsuccessful. Attempts were made using a Lunderquist wire

Figure 1) Hairpin turn, right iliac artery

(Cook Medical Inc), dilators and sheaths, none of which would pass. The patient was at extremely high risk of iliac arterial trauma-related morbidity and mortality associated with AAA repair. Due to the patient's advanced age and comorbidities, it was determined that the patient would be best served by endograft placement for treatment of his AAA.

After initiating epidural anesthesia, exposure was gained through the right inguinal area with a transverse incision at the site of the inguinal ligament. The patient had previous scarring from a right inguinal hernia repair and an appendectomy. The inguinal ligament was not taken down to the origin and insertion, but was freed medially and laterally through the same

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Figure 2) Iliac artery occlusion with wire placement

incision to allow complete reflection of the inguinal ligament (the ligament was not transected, and thus, there was no need for any subsequent ligament repair). The common femoral, profunda femoris, superficial femoral and circumflex iliac femoral arteries were dissected free and vessel looped for control. The external iliac artery was dissected under the ureter on the right side, completely freeing up all fibres of the external iliac artery. The circumflex iliac femoral arteries were ligated with 2-0 silk ties and clips, thereby allowing the external iliac artery to be completely straightened and brought up as a loop within the groin as a new extended common femoral artery (Figure 3).

Endografting of the AAA was then performed. After wire placement was easily accomplished, the aorta was accessed through the right iliac artery. The sheath was then placed for AAA endografting without incident. Following this procedure, the patient underwent resection of an 8 cm segment of the newly formed external iliac and common femoral artery junction with an end-to-end anastomosis using a 6-0 prolene suture. In addition, the patient required coverage of the right internal iliac artery during the procedure for treatment of the common iliac aneurysm. Excellent blood flow to the leg was restored at the completion of the procedure. The patient was discharged the following morning. Follow-up at 180 days postoperatively revealed no endoleak and normal arterial flow.

DISCUSSION

Minimally invasive surgical procedures have increased substantially as techniques, surgeon experience and device development have evolved. Nonetheless, not all patients are candidates for minimally invasive procedures because of physiological conditions, comorbidities and, as in the present case, vascular anatomical deviations.

It is not uncommon for the iliac arteries to present difficult access due to occlusive disease, stenosis, calcifications and/or tortuosity. As more patients meet eligibility requirements for endovascular aneurysm repair (EVAR), new techniques to

Figure 3) Tortuous portion of right external iliac artery

circumvent anatomically challenging vascular access must be developed. Carroccio and Spielvogel (1) recently described combined open and endovascular techniques for treating AAA when confronted with complex vascular anatomy prohibiting traditional access for endovascular repair. Such combined techniques avoid the morbidity and mortality associated with complete open repair and offer the benefits of minimally invasive repair in terms of lower risk to the patient, shorter hospital stay and shorter recovery time. In the case of severe occlusive disease with calcifications and vessel tortuosity, they describe methods of avoiding the iliac segment, such as through an extraluminal side arm conduit via a retroperitoneal approach.

Moise et al (2) studied barriers to endovascular AAA repair in two groups of patients divided according to early and late time periods in their experience in performing EVAR. The early procedures were performed between April 1997 and June 2000 (n=307) and late procedures were those performed between July 2000 and December 2003 (n=240). The exclusion criteria for EVAR are shown in Table 1 (3). Significantly fewer patients in the late experience group were excluded for EVAR due to iliac tortuosity (10 early, one late; $P<0.0165$).

With regard to iliac pathology, specifically tortuosity, rates of exclusion for EVAR have been reported by several authors. Henretta et al (4) treated 74 patients with EVAR over a 19 month period and found high rates of iliac pathology; 35 (47%) had iliac anatomical pathology, with iliac tortuosity occurring in 27 of the 74 patients (36%) that required brachial guidewire tension to facilitate tracking of the delivery device in two patients. These and other investigators' rates of iliac tortuosity are shown in Table 2 (2-7).

TABLE 1

Zenith* endograft exclusion criteria for endovascular aneurysm repair

Characteristic	Exclusion size
Aortic neck diameter	>32 mm
Aortic neck length	<15 mm
Aortic neck angulation	>60°
Severe iliac tortuosity	
Extensive aortic neck thrombus	
Access artery diameter (iliac arteries)	<7 mm
Aortic bifurcation diameter	<18 mm
Bilateral common iliac artery aneurysm requiring coverage of both hypogastric arteries	
Essential accessory renal artery	

*Cook Medical Inc, USA

Dawson et al (8) present two cases of iliac artery kinking during endovascular procedures that resolved after removing the stiff guidewire and the instrumentation. The first case involved endovascular treatment of an infrarenal AAA, with tortuosity in both common and external iliac arteries (both were patent and free of aneurysm). After introducing and deploying a 28 mm × 16 mm × 16.5 cm modular bifurcated aortic endoprosthesis (AneuRx, Medtronic AVE, USA), the authors cannulated the iliac gate with a 0.035 in diameter hydrophilic guidewire guided by a 5 Fr vertebral catheter. They then exchanged the wire with a super stiff wire for deployment of the contralateral limb. Aortography showed good graft position but no flow through the right graft limb. Right iliac arteriography showed a kink just distal to the iliac artery bifurcation. Withdrawal of the super stiff wire followed by aortography showing that the kink had resolved due to the wire removal manoeuvre and that there was normal flow of contrast material.

The second case, an attempt at embolization of a 9 cm splenic mass, found marked tortuosity of the external iliac artery. After insertion of a Kumpe catheter, arteriography

TABLE 2

Published rates of iliac pathology leading to exclusion from endovascular aneurysm repair

Authors (reference), year of publication	Patients, n	Patients excluded, n	Patients excluded because of iliac pathology, n (%)
Henretta et al (4), 1999	74	Not given	–
Carpenter et al (5), 2001	307	103	10 (10)
Arko et al (6), 2004	220	98	7 (7)
Lalka et al (3), 2005	317	212	15 (7.1)
Moise et al (2), 2006	547	201	11 (5)
Cotroneo et al (7), 2006	130	79	6 (7.6)

showed a long dissection of the external iliac artery along with greatly decreased intraluminal pressure. The authors placed a stent in the dissection via the left femoral approach over a super stiff wire, which shortened the artery and created an 'accordion-like' kink. Withdrawal of the stent deployment device and guidewire eliminated the kinking and allowed embolization of the splenic mass. In cases such as these, temporary kinking or tortuosity may be caused by the placement of devices and stiff guidewires and may resolve with their removal.

In the present case, we unsuccessfully attempted to straighten the tortuous iliac artery with wires. We considered creating an ileoconduit, which would require a large retroperitoneal incision. Alternatively, we were able to address the tortuosity of the external iliac artery through a simple transverse groin incision, thereby alleviating a much larger incision, which was less morbid for the patient.

Iliac arterial pathology is not an uncommon finding when evaluating patients for AAA repair. With the use of EVAR increasing, techniques developed for achieving vascular access may allow more patients with iliac pathology to become eligible for this minimally invasive AAA repair procedure. The present case describes a novel way to achieve this goal.

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