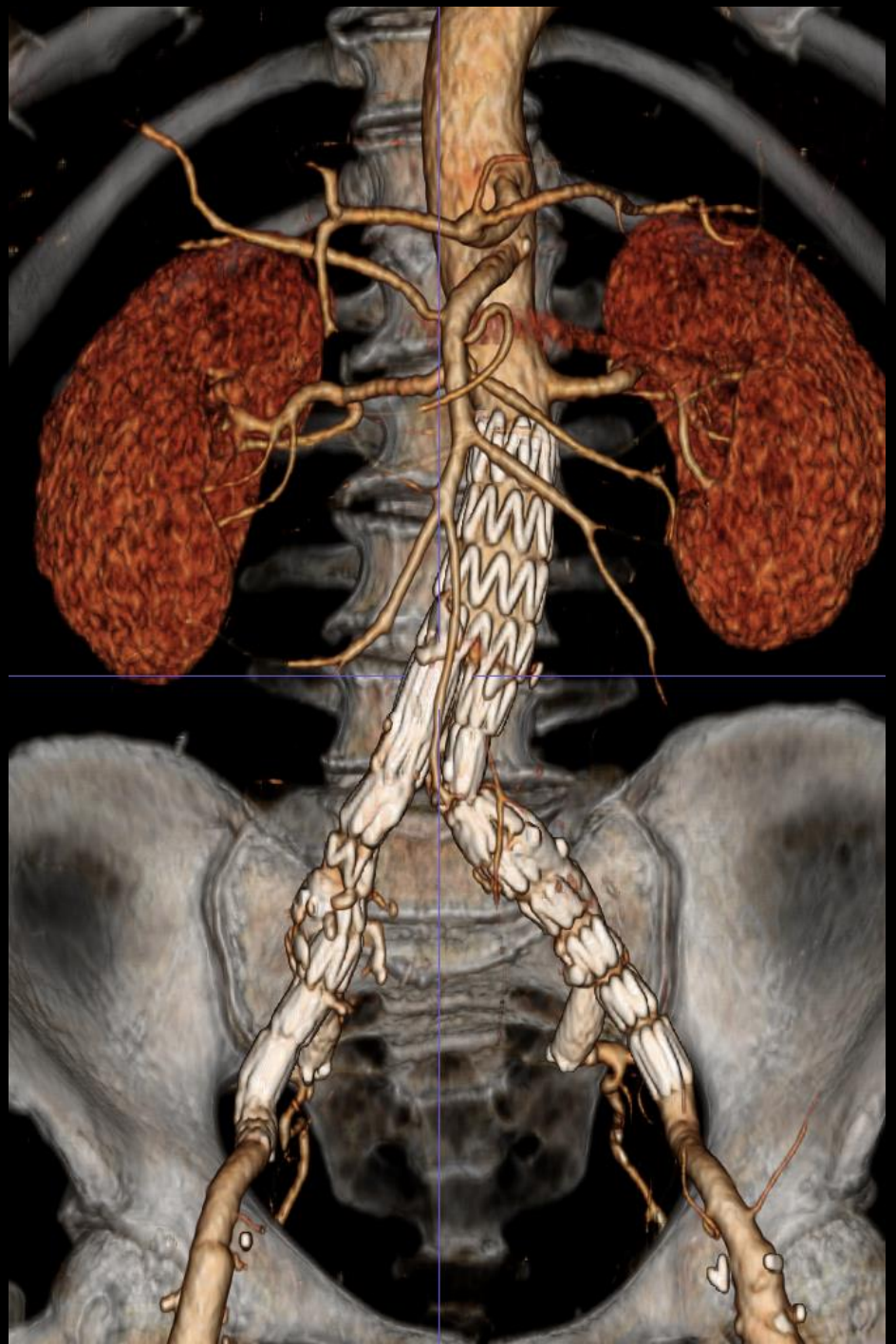

10 years experience with the Zenith Iliac Branch

Literature overview

Blandine MAUREL, MD, PhD
CHU Nantes, France

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Disclosures

- Cook Medical -- Proctorship

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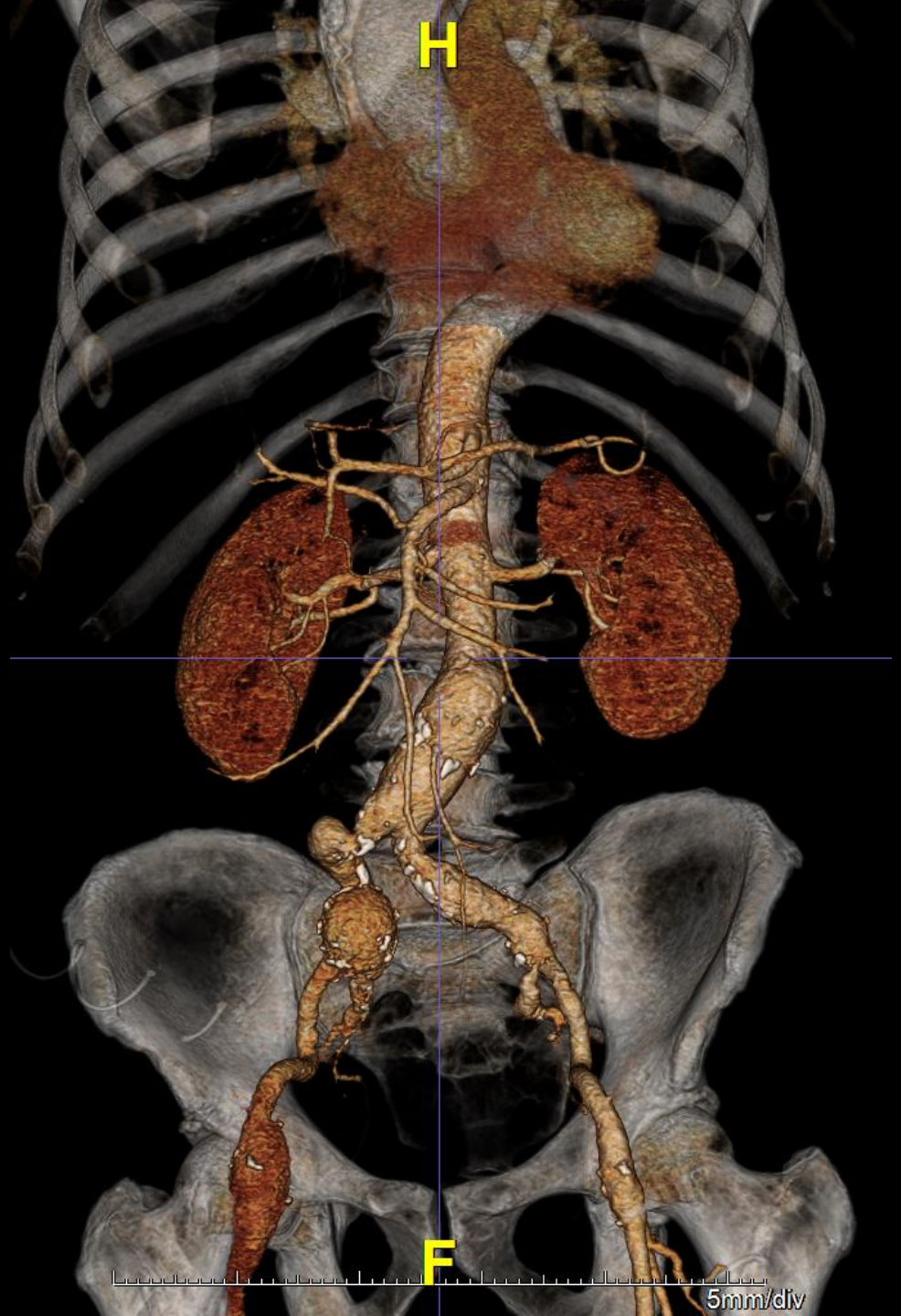

Why bother about iliac aneurysm ??

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Common Iliac Aneurysms

- **endovascular definition of CIA aneurysm : >20mm =** *lack of sealing using a large distal stent graft*
- **10-40% of all AAA are associated with unilateral or bilateral CIA aneurysms**
- **adds a level of complexity to open or endovascular repair of AAA**
- **increases the risk of late failure** *(distal endoleak)*

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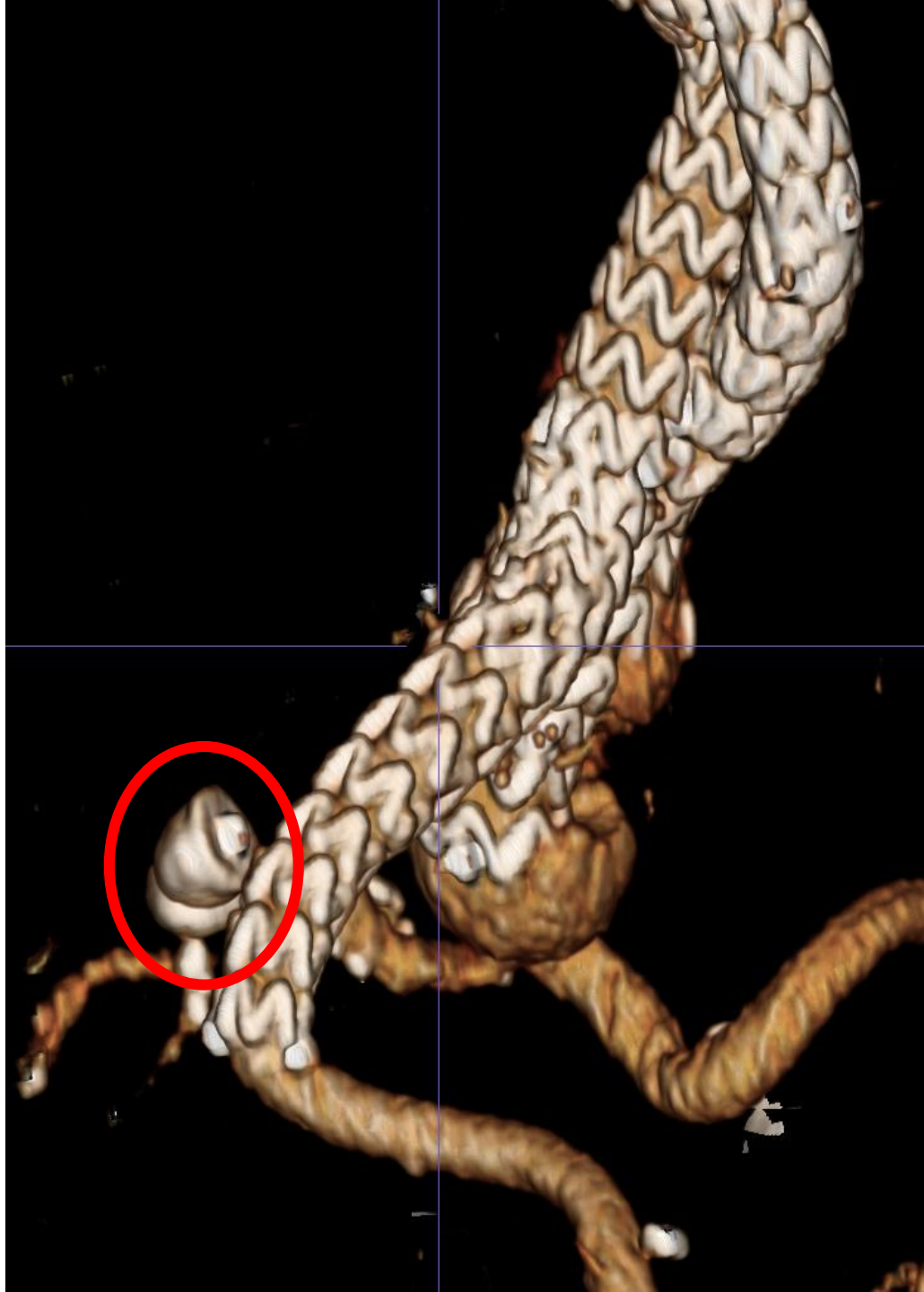
Lee et al. J VascSurg 2002;35:1289-91
Schanzer et al, 2011.
Park et al, *J. Korean Med. Sci* 2011
Eurostar registry

Common Iliac Aneurysms

- Exclusion may require internal iliac embolization
- Associated with ischemic complication risks
- Especially if the occlusion is bilateral



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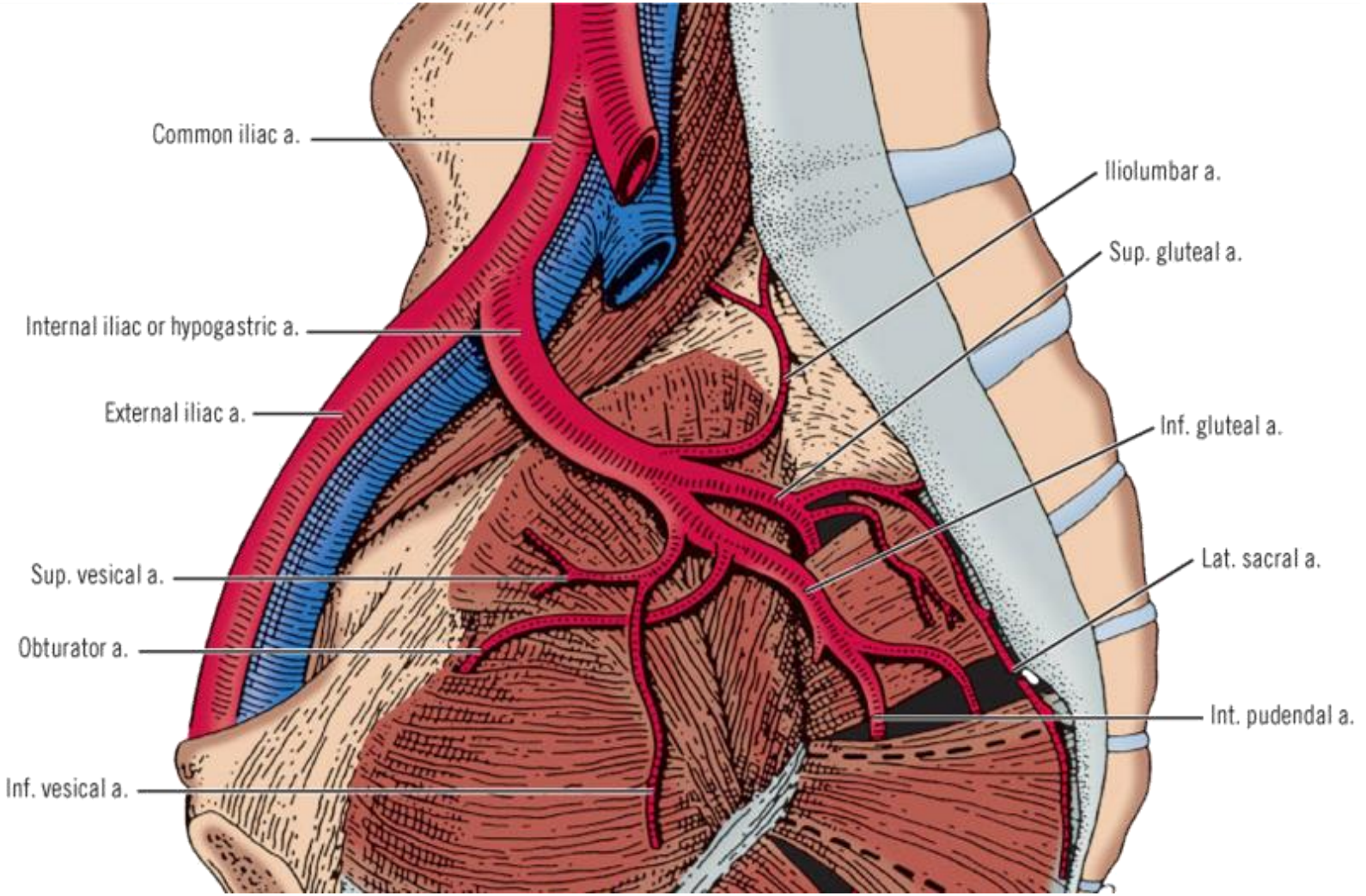
IIA supply blood to the pelvis



IIA occlusion: ischemic symptoms

	Kouvelos, 2016 27 studies 1260 patients
Claudication	29% [27% unilat / 36% bilat]
Sexual dysfonction	13%
Colon ischemia	0.5%
Spinal cord ischemia	0.3%
Buttock necrosis	0.7%
Endoleak from IIA	*3.1%*

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Claudication after IIA occlusion

- 25% post operative buttock claudication
- 85% persistent claudication at 18 months
- lead to severe quality of life impairment when it does not regress during follow-up

Pelvic ischemia and quality of life scores after interventional occlusion of the hypogastric artery in patients undergoing endovascular aortic aneurysm repair

Elixène Jean-Baptiste, MD, PhD,[a,b] Sophie Brizzi, MD,[a,b] Michel A. Bartoli, MD, PhD,[c] Nirvana Sadaghianloo, MD,[a,b] Jean Baqué, MD,[a,d] Pierre-Edouard Magnan, MD,[c] and Réda Hassen-Khodja, MD,[a,b] *Nice and Marseille, France*

Objective: The aim of this study was to analyze the pelvic ischemic complications and their impact on quality of life after interventional occlusion of the hypogastric artery (IOHA) in patients undergoing endovascular aortic aneurysm repair (EVAR).

Methods: Between January 2004 and April 2012, 638 consecutive patients with aortoiliac aneurysm treated by EVAR were prospectively registered in two teaching hospitals. We identified all EVAR patients who underwent IOHA. Demographic, clinical, and radiologic data were extracted from electronic databases and patient records as requested. All patients who survived the postoperative period took part in a quality of life survey, the Walking Impairment Questionnaire (WIQ), which included four items: pain, distance, walking speed, and stair climbing. Outcome measures included the 30-day rate of pelvic ischemic complications, the buttock claudication (BC) rate at 30 days and during follow-up, and the comparative WIQ scores between patients with persistent BC, those with regressive BC, and those who never had BC after the IOHA procedure.

Results: A total of 71 patients (97% men; mean age, 76 years ± 7.69) required 75 IOHA procedures. These were deemed proximal in 44 cases and distal in 31, with use of coil embolization in 64%, Amplatzer plug in 24%, or a combination of coils and plugs in 12%. The technical success rate was 100%. Two patients (2.8%) experienced fatal acute pelvic ischemic complications in the postoperative period after EVAR. Another patient died of iliac rupture during EVAR, leading to an operative mortality rate of 4.3%. Eighteen patients (25.3%) suffered BC, among whom 11 cases resolved at a median follow-up of 42 months. Young age (odds ratio, 0.92; 95% confidence interval, 0.85-0.99; $P = .03$) and distal IOHA (odds ratio, 3.5; 95% confidence interval, 1.01-11.51; $P = .04$) were independent predictors of BC occurrence. The actuarial rate of persistent BC was 85% at 18 months. The WIQ scores were lower for patients with persistent BC (median score, 35.04; interquartile range, 16.36; $P = .001$) compared with patients with regressive BC (median score, 76.5; interquartile range, 36.66; $P = .02$) or those who never experienced BC after the IOHA procedure (median score, 65.34; interquartile range, 10.94; $P < .0003$).

Conclusions: Pelvic ischemia associated with IOHA may be severe and lead to fatality after EVAR. Our data show that BC may lead to severe quality of life impairment when it does not regress during follow-up. (J Vasc Surg 2014;60:40-9.)

Interventional occlusion of the hypogastric artery (IOHA) is commonly performed in patients undergoing endovascular aortic aneurysm repair (EVAR), especially when the aneurysmal process extends to one or both of the iliac artery bifurcations. Potential drawbacks include a higher incidence of pelvic ischemia, with acute or chronic clinical consequences such as sciatic nerve palsy, paraplegia, gluteal necrosis, colonic ischemia, and buttock claudication (BC).[1-6] This last complication is particularly frequent but often ignored or considered benign by clinicians. The full effect of BC, as a marker of chronic pelvic ischemia, and its impact on patients' daily walking ability may be underestimated. Poor clinical assessment criteria, lack of prospectively collected data in reported series, and possible confusion with common mobility-limiting conditions in the target population make the evaluation of BC even more difficult.

Assessment of functional capacity and walking ability is important in determining disease severity, evaluating treatment, and assessing quality of life in claudicants.[7] Treadmill testing is the standard measure to assess walking ability as expressed in meters. However, there is often discrepancy between subjectively experienced daily walking ability,

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Author conflict of interest: none.

Additional material for this article may be found online at www.jvascsurg.org.

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Spinal cord ischemia

	Immediate SCI (n=15)	Delayed SCI (n=21)
≥ 1 occlusion (IIA or LSCA)	73%*	14%
≥ 2 occlusions (IIA ou LSCA)	13%	5%

From the Society for Vascular Surgery

Hypogastric and subclavian artery patency affects onset and recovery of spinal cord ischemia associated with aortic endografting

Matthew J. Eagleton, MD, Samir Shah, MD, Dan Petkosevek, BS, Tara M. Mastracci, MD, and Roy K. Greenberg, MD, *Cleveland, Ohio*

Objective: Spinal cord ischemia (SCI) is a devastating complication associated with aortic aneurysm repair. The aim of the current study was to evaluate factors affecting outcomes from SCI associated with endovascular aortic aneurysm repair.
Methods: A total of 1251 patients underwent endovascular repair of aortic aneurysm as part of a device trial between 1998 and 2010 utilizing endovascular abdominal aortic aneurysm repair (n = 351), thoracic endovascular aortic aneurysm repair (n = 201), fenestrated endovascular aortic aneurysm repair (n = 227), and visceral branched endografts (n = 472). Records and imaging studies were reviewed to supplement prospective outcome data. Demographics, type of repair, collateral bed (hypogastric/subclavian) patency, clinical presentation, and outcomes were evaluated on patients with SCI. Survival was calculated using life-table analysis.
Results: SCI occurred in 2.8% (n = 36) of patients: abdominal aortic aneurysm, 0.3%, juxtarenal, 0.4%, thoracic aortic aneurysm, 4.6%, and thoracoabdominal aortic aneurysm, 4.8%). Four (11%) required carotid-subclavian bypass prior to endografting, and two underwent coverage of the left subclavian artery. Unilateral hypogastric artery occlusion was present in 11 (31%) patients prior to endograft placement, and three had bilateral occlusions. An additional seven patients had occlusion of at least one hypogastric artery during surgery. SCI was apparent immediately in 15 (42%) patients. Immediate onset of symptoms was observed in 73% of patients with at least one occluded collateral bed but in only 24% of those with patent collateral beds ($P = .021$). Of those presenting in a delayed fashion, nine (43%) had a clear precipitating event prior to onset of SCI (hypotension, n = 6, and segmental artery drain removal, n = 3). Recovery occurred in 24 (67%) patients, most within 7 days. Immediate presentation was a negative predictor of recovery ($P = .025$), as was occlusion of at least one collateral bed ($P = .035$). Mean follow-up was 22 ± 4 months with 30-day and 1-year survival of 92 ± 4.6% and 56 ± 8.3%. Survival was only 36% at 3 months in those with permanent SCI compared with 92% ($P < .001$) in those with temporary symptoms.
Conclusions: SCI continues to complicate aortic surgery despite the advent of endovascular therapy. Occlusion of a single collateral bed is associated with an increased risk for immediate onset of SCI and lack of recovery. These factors are harbingers of poor outcomes and increased short-term mortality. This may be prevented by preserving collateral bed patency in patients undergoing extensive endovascular procedures. (J Vasc Surg 2014;59:89-95.)

Spinal cord ischemia (SCI) is a devastating complication associated with aortic surgery. The incidence of SCI has been well documented following conventional open surgery for abdominal aortic aneurysms (AAAs), thoracic aortic aneurysms (TAAs), and thoracoabdominal aortic aneurysms (TAAAs), and it occurs at an incidence approaching 20% depending on the extent of the aorta that is replaced and associated risk factors.[1-4] Significant efforts have been extended to understand the pathophysiology of SCI. Based on these investigations, perioperative management strategies have been developed to prevent its occurrence and lessen the untoward clinical impact, primarily in patients with TAAAs. These adjuncts include the use of permissive hypothermia, epidural cooling, cerebral spinal fluid drainage, left heart bypass, the use of intrathecal papaverine, and reimplantation of intercostal vessels.[3-7] These modalities either help to preserve cord function through limiting the metabolic effects of SCI, or to promote increased perfusion through the spinal cord collateral flow network. Application of these efforts has allowed clinicians to significantly reduce rates of SCI over the past decade.

The development and broad application of endovascular technology has revolutionized the approach to treating aortic disease. The use of this technology, however, has not ameliorated the complication of SCI. Its incidence, as would be expected, is rare in patients undergoing endovascular abdominal aortic aneurysm repair (EVAR)[8] and occurs at rates ranging from 2% to 10% following thoracic endovascular aneurysm repair (TEVAR).[9] The evolution of fenestrated and branched aortic endograft

From the Department of Vascular Surgery, Cleveland Clinic Lerner College of Medicine.
Author conflict of interest: Dr Eagleton has been paid consulting fees by Cook Medical (Bloomington, Ind). Dr Greenberg has been paid consulting fees and receives research funding from Cook Medical.
Presented at the Plenary Session of the 2013 Vascular Annual Meeting of the Society for Vascular Surgery, San Francisco, Calif, May 31, 2013.
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Spinal cord ischemia

During extensive endovascular aortic repair, every efforts have to be made to maintain the perfusion of at least one internal iliac artery

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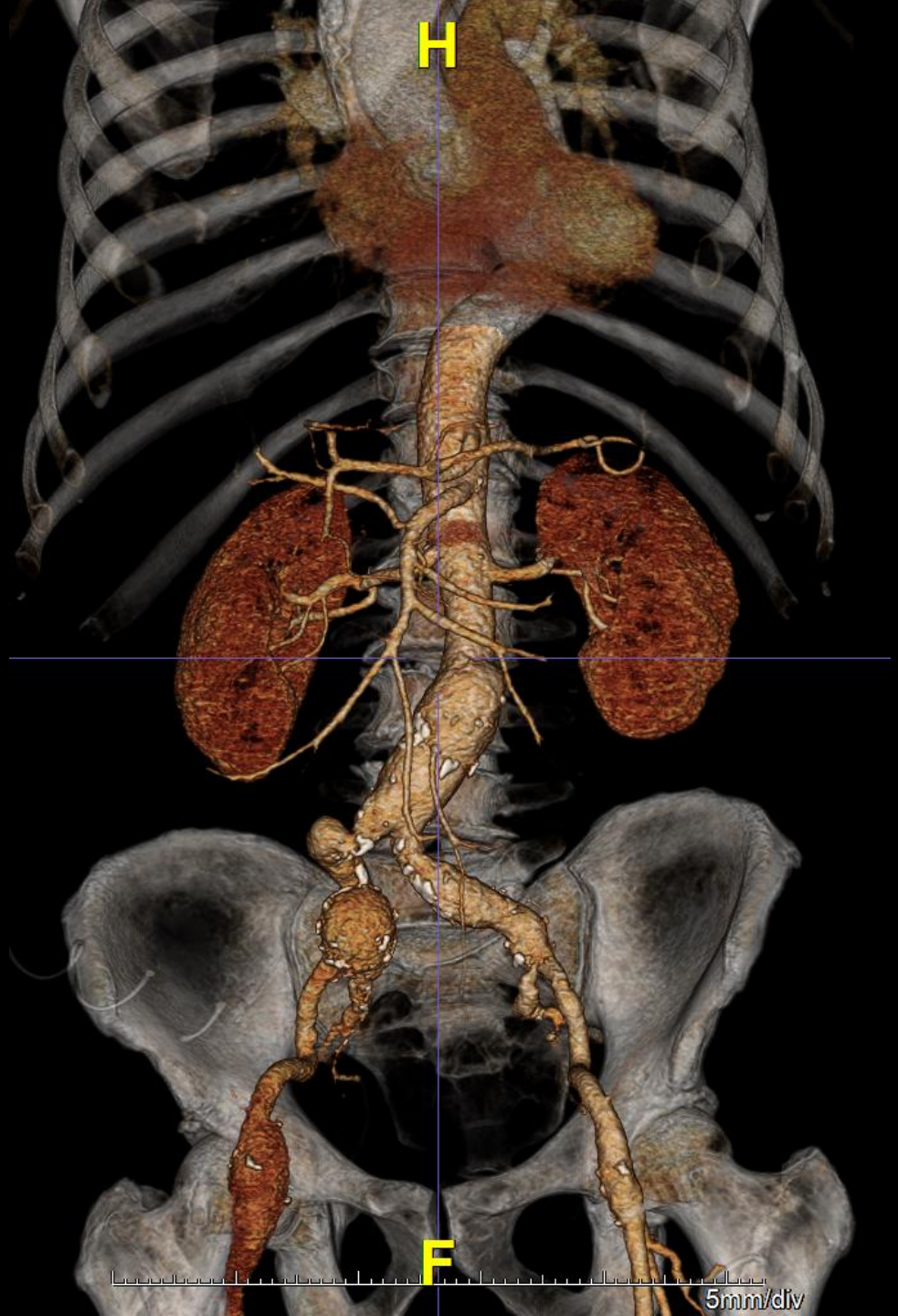

History of iliac aneurysm endovascular treatment

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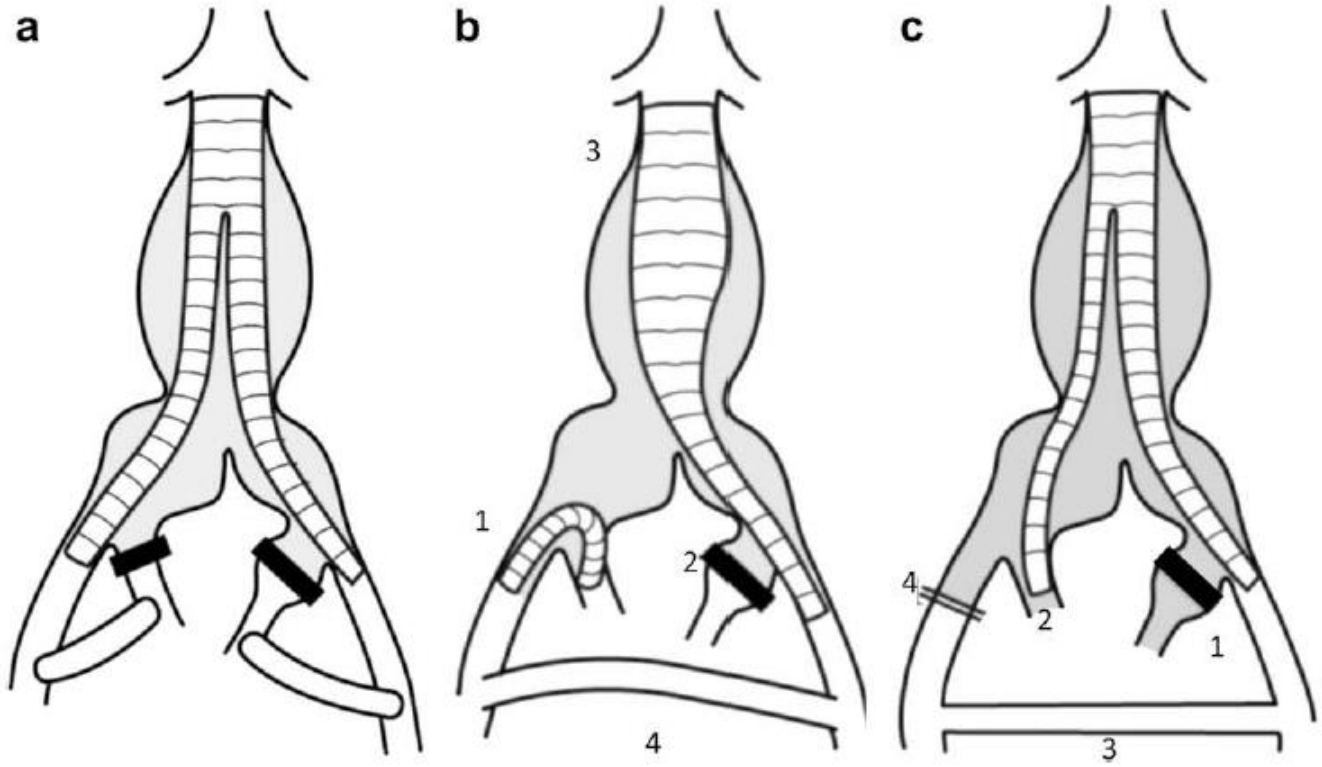
Hybrid interventions



Various techniques of hybrid IIA preservation : relocation of origin of IIA / femoro femoral bypass with IIA retrograde or antegrade stenting

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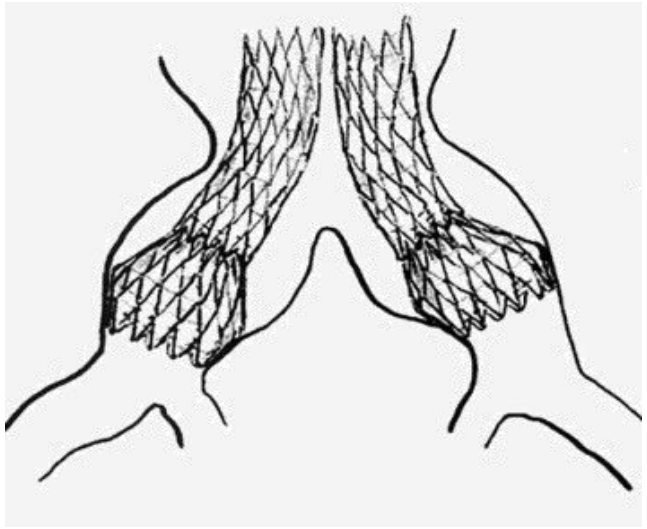
Gosh 2009

Bell-bottom technique

- Large cuff
- Avoids per procedural endoleak
- Long term follow up questionable : associated with increased need for secondary intervention due to progression of artery dilatation



Bell-bottom aortoiliac endografts: An alternative that preserves pelvic blood flow

Boonprasit Kritpracha, MD, John P. Pigott, MD, Todd E. Russell, MD, Mary Jo Corbey, RN, Ralph C. Whalen, MD, Robert S. DiSalle, MD, Charles I. Price, MD, Ian A. Sproat, MD, and Hugh G. Beebe, MD, *Toledo, Ohio*

Objective: Dilated common iliac arteries that complicate aortic aneurysm stent grafting usually have been managed with endograft extension across the iliac artery bifurcation with internal iliac artery (IIA) occlusion. We studied 25 patients with significant common iliac artery (CIA) dilation treated with two methods: endograft extension across the iliac bifurcation or a new approach with a flared cuff within the CIA that preserves the IIA.

Methods: Of 86 patients with abdominal aortic aneurysm (AAA) who underwent bifurcated endovascular stent grafting (ESG), 25 (29.1%) had at least one dilated CIA. Two treatment groups had different methods of management of iliac artery dilation. Group 1 underwent ESG with straight extension across the iliac bifurcation and IIA coil embolization before the ESG procedure (n = 2) or simultaneously with ESG (n = 8). Group 2 underwent ESG with flared distal cuff (AneuRx, Medtronic AVE, Santa Rosa, Calif) contained within the CIA, the so-called "bell-bottom" procedure, thus preserving the IIA (n = 15). Iliac artery dimensions, operating room time, fluoroscopy time, and postoperative complications were prospectively gathered.

Results: Two women and 23 men had mean diameters of AAA of 56.6 mm (range, 38 to 98 mm) and of CIA of 21.4 mm (range, 15 to 48 mm). The diameters of CIA treated with device extension into external iliac artery after IIA coil embolization in group 1 and with the bell-bottom procedure in group 2 were not different (mean CIA diameter, 19.9 mm; range, 15 to 26 mm; and mean, 19.1 mm; range, 15 to 24 mm; respectively). However, significantly lower operating room and catheter procedure times were found in group 2 compared with group 1 (137 versus 192 minutes; 58 versus 106 minutes; $P = .02$ and .02, respectively). No periprocedural type I endoleaks were found in either group. Nine patients in group 2 also had a second contralateral CIA aneurysm, and five patients (mean CIA diameter, 33.0 mm; range, 22 to 48 mm) underwent treatment with extension across the iliac artery bifurcation and IIA occlusion. Use of the bell-bottom procedure on the other side allowed preservation of one IIA. Four cases (mean diameter, 19.3 mm) also underwent contralateral bell-bottom procedure. Two of these group 2 patients had complications, with severe buttock claudication in one and distal embolism necessitating limb salvage bypass after preoperative coil embolization of the IIA in another.

Conclusion: Significant CIA ectasia or small aneurysm is often associated with AAA. In such cases, the bell-bottom procedure that preserves IIA circulation is a new alternative to the common practice of placement of endograft extensions across the iliac artery bifurcation in patients with at least one CIA diameter of less than 26 mm. Additional benefits include reduced total procedure time. Early technical success appears to justify continued use. However, long-term evaluation is necessary to determine durability because the risk of rupture as the result of potential expansion of the excluded iliac artery or late failure is unknown. (J Vasc Surg 2002;35:874-81.)

Endovascular stent graft (ESG) repair of abdominal aortic aneurysm (AAA) is rapidly becoming an acceptable alternative treatment since first reported by Parodi, Palmaz, and Barone.[1] Careful patient and device selection are critically important for achieving the best results with this technique for treatment of AAA. However, challenging aortoiliac anatomy, such as diseased proximal neck or angled tortuous vessels, is present in a significant number of patients considered candidates for ESG. The common iliac artery (CIA) plays a crucial role because it is the distal attachment zone for the stent graft and must be completely sealed to assure exclusion of the aneurysm. One or both CIAs are dilated in 16% to 30% of ESG cases,[2-7] making them unsuitable for adequate distal sealing with commercially available endovascular devices. The dilated CIA may be ectatic or aneurysmal, more than 18 mm or greater than 50% of adjacent normal artery,[8] which is larger than the diameter of device limbs currently available.

In patients treated with ESG, limb extension into the external iliac artery (EIA) with coil embolization of the ipsilateral internal iliac artery (IIA) for prevention of retrograde endoleak into the aneurysm sac is the common management of dilated CIA. Reports claim the relative safety of occlusion of one or both IIAs during ESG.[2,3] However, other investigators have reported serious pelvic ischemic complications.[4-7,9,10] Relocation of the iliac bifurcation with surgical implantion of the IIA onto the distal EIA to preserve pelvic blood flow as proposed by Parodi and Ferreira[11] is another option for management of dilated CIA. Another less invasive method is use of a flared cuff, the so-called "bell-bottom" technique, that anchors the device

From the Jobst Vascular Center.
Competition of interest: nil.
Presented at the Twenty-fifth Annual Meeting of the Midwestern Vascular Surgical Society, Chicago, Ill, Sep 21-22, 2001.
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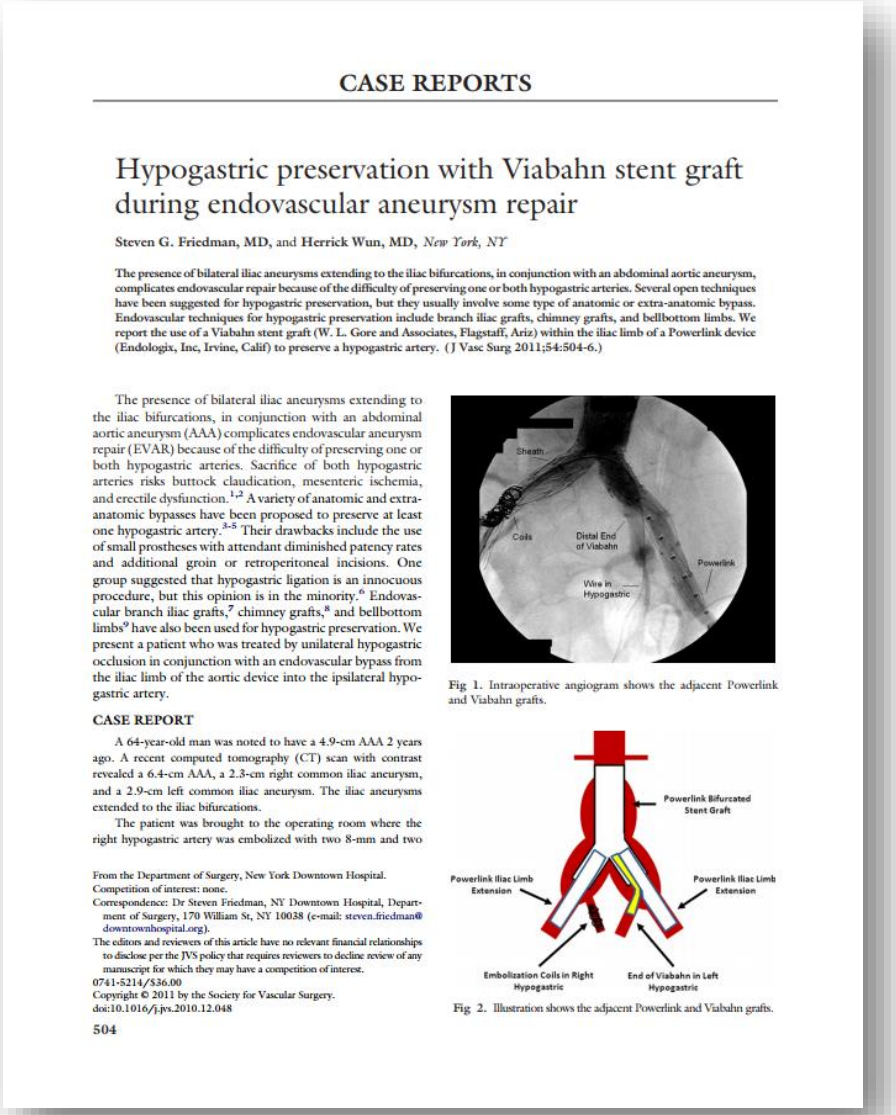
0741-5214/2002/$35.00 + 0 24/6/123326
doi:10.1067/mva.2002.123326

“Snorkel/chimney and sandwich/parallel” technique

Overlap > 5cm with EIA stentgraft

Risks :

- **endoleak within the gutters**
- **increased risk for compression and thrombosis**
- **neurological due to transbrachial approach**



CASE REPORTS

Hypogastric preservation with Viabahn stent graft during endovascular aneurysm repair

Steven G. Friedman, MD, and Herrick Wun, MD, *New York, NY*

The presence of bilateral iliac aneurysms extending to the iliac bifurcations, in conjunction with an abdominal aortic aneurysm, complicates endovascular repair because of the difficulty of preserving one or both hypogastric arteries. Several open techniques have been suggested for hypogastric preservation, but they usually involve some type of anatomic or extra-anatomic bypass. Endovascular techniques for hypogastric preservation include branch iliac grafts, chimney grafts, and bellbottom limbs. We report the use of a Viabahn stent graft (W. L. Gore and Associates, Flagstaff, Ariz) within the iliac limb of a Powerlink device (Endologix, Inc, Irvine, Calif) to preserve a hypogastric artery. (J Vasc Surg 2011;54:504-6.)

The presence of bilateral iliac aneurysms extending to the iliac bifurcations, in conjunction with an abdominal aortic aneurysm (AAA) complicates endovascular aneurysm repair (EVAR) because of the difficulty of preserving one or both hypogastric arteries. Sacrifice of both hypogastric arteries risks buttock claudication, mesenteric ischemia, and erectile dysfunction.[1,2] A variety of anatomic and extra-anatomic bypasses have been proposed to preserve at least one hypogastric artery.[3-5] Their drawbacks include the use of small prostheses with attendant diminished patency rates and additional groin or retroperitoneal incisions. One group suggested that hypogastric ligation is an innocuous procedure, but this opinion is in the minority.[6] Endovascular branch iliac grafts,[7] chimney grafts,[8] and bellbottom limbs[9] have also been used for hypogastric preservation. We present a patient who was treated by unilateral hypogastric occlusion in conjunction with an endovascular bypass from the iliac limb of the aortic device into the ipsilateral hypogastric artery.

Fig 1. Intraoperative angiogram shows the adjacent Powerlink and Viabahn grafts.

CASE REPORT

A 64-year-old man was noted to have a 4.9-cm AAA 2 years ago. A recent computed tomography (CT) scan with contrast revealed a 6.4-cm AAA, a 2.3-cm right common iliac aneurysm, and a 2.9-cm left common iliac aneurysm. The iliac aneurysms extended to the iliac bifurcations.

The patient was brought to the operating room where the right hypogastric artery was embolized with two 8-mm and two

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Competition of interest: none.
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The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a competition of interest.
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doi:10.1016/j.jvs.2010.12.048

Fig 2. Illustration shows the adjacent Powerlink and Viabahn grafts.

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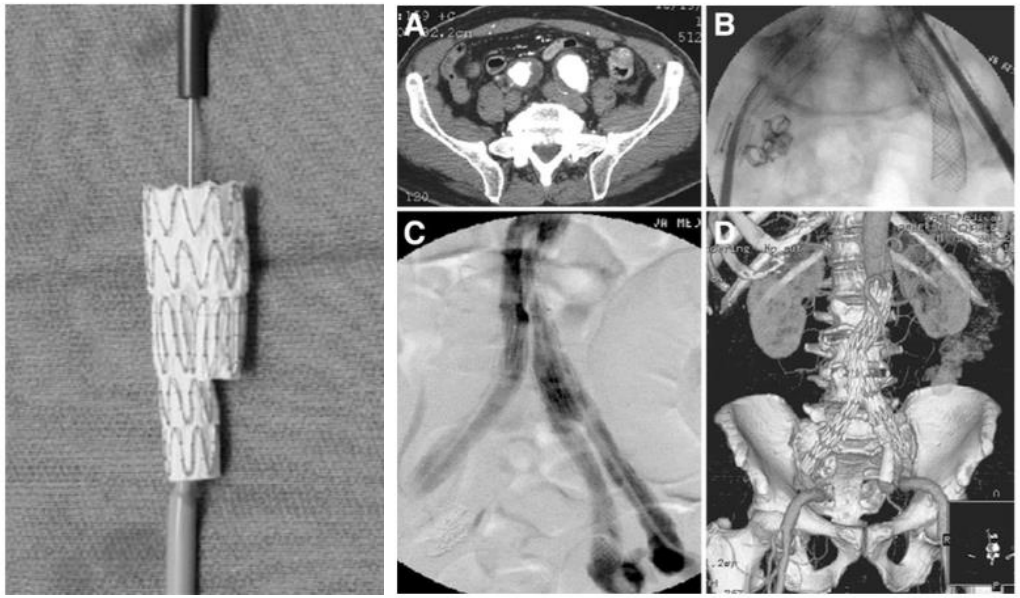
Early iliac branch experience

- **Stent graft first described by Abraham et al. In 2003**



J ENDOVASC THER
2003;10:203–207

TECHNICAL NOTE

A Modular Multi-Branched System for Endovascular Repair of Bilateral Common Iliac Artery Aneurysms

Cherrie Z. Abraham, MD; Linda M. Reilly, MD; Darren B. Schneider, MD; Shelley Dwyer, RN; Rajiv Sawhney, MD*; Louis M. Messina, MD; and Timothy A.M. Chuter, MD

Divisions of Vascular Surgery and *Interventional Radiology, University of California, San Francisco, California, USA

Purpose: To describe a modular stent-graft for cases of bilateral common iliac aneurysm.
Technique: The aortic aneurysm is repaired using a standard bifurcated modular system (Zenith). A modified bifurcated component is deployed with its trunk in one limb of the original aortic stent-graft, its long limb in the external iliac artery, and its short limb in the iliac aneurysm just above the internal iliac orifice. A flexible extension is introduced from the right brachial artery and used to bridge the gap between the short limb of the modified bifurcated component and the left internal iliac artery.
Conclusions: Endovascular repair of bilateral iliac aneurysm is feasible using a modular stent-graft with separate branches to the internal and external iliac arteries.
J Endovasc Ther 2003;10:203–207

Key words: abdominal aortic aneurysm, iliac artery aneurysm, common iliac artery, Zenith Trifab stent-graft, branched endograft, Wallgraft, Jomed stent-graft

Endovascular abdominal aortic aneurysm (AAA) repair is a desirable option for patients whose comorbidities preclude standard open operative repair. Unilateral iliac aneurysms usually require internal iliac artery occlusion and external iliac artery implantation of the stent-graft. Bilateral common iliac aneurysms present more difficulty because bilateral internal iliac artery occlusion may cause intestinal ischemia, lumbosacral plexopathy, and buttock claudication.[1,2] Under these circumstances, internal iliac flow may be maintained through an external-to-internal iliac artery bypass[3,4] or through the side branch of a complex stent-graft. Inoue et al.[5] have described the insertion of a unibody stent-graft for this purpose. We prefer a modular multi-branched approach in which an iliac bifurcation is created using modified Zenith components.

TECHNIQUE

Stent-Graft Sizing and Preparation

Selection of the Zenith main body (Cook, Inc., Bloomington, IN, USA) follows the usual protocol for AAA repair. In general, the proximal trunk diameter is oversized by 4 to 6 mm relative to the outer diameter of the neck on computed tomography (CT). Iliac extensions with an intended implantation site in the common iliac aneurysm are sized so as to be slightly smaller than the proximal diameter of the bifurcated iliac component (22 mm).

Sponsored in part by grants from the Pacific Vascular Research Foundation. Dr. Chuter has licensed patents to Cook, Inc., manufacturer of the Zenith device.

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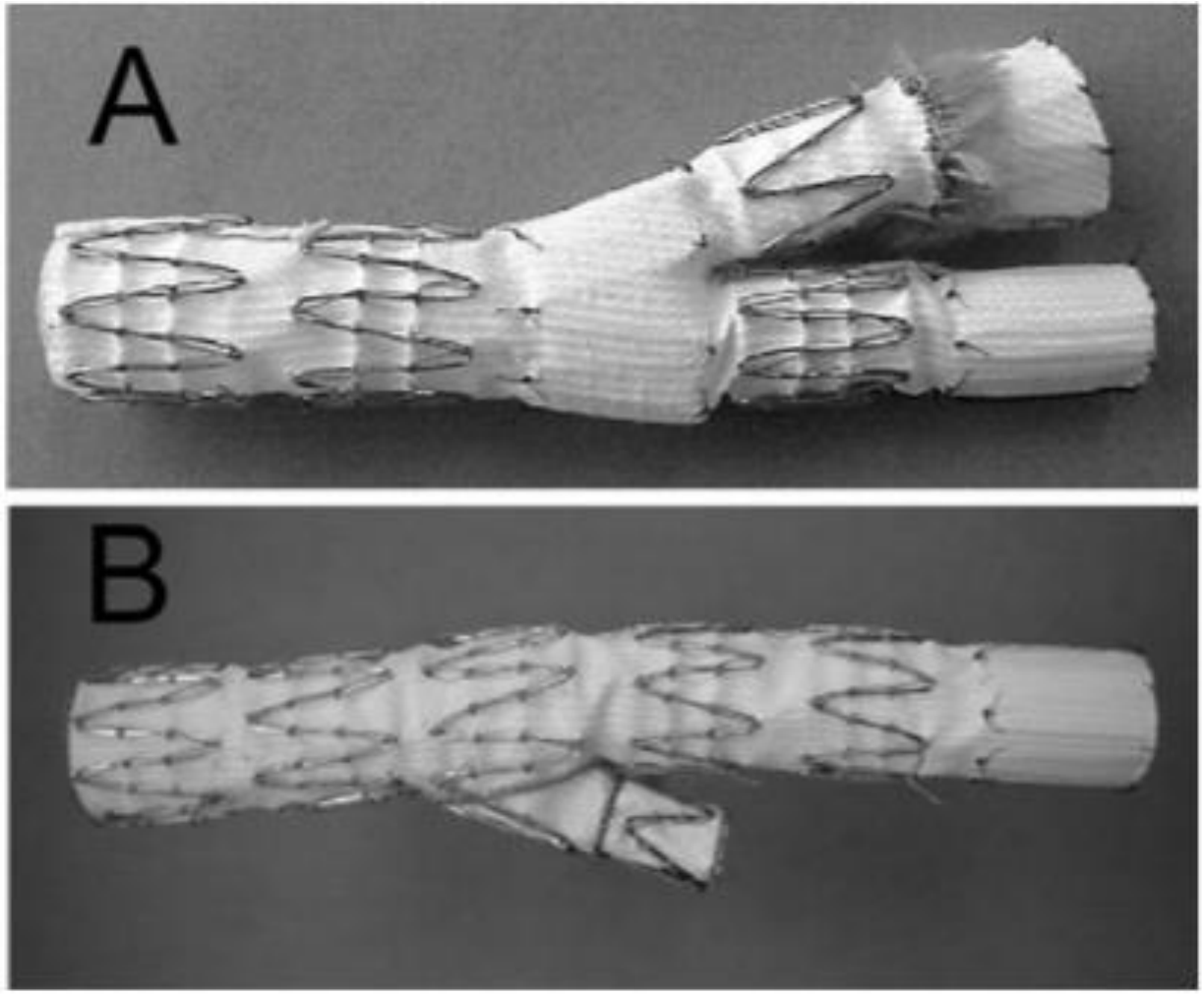
Early iliac branch experience



Ziegler et al, JVS 2007

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Modern days results with Iliac branch device

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Modern outcomes

	N	Technical success	IIA occl	Endoleak I III	Free from reintervention
Donas, 2017	575	97.6%	1.6%	2.5%	8y : 86%
Jongsma 2017	162	96.9%	9.3%	7%	5y: 76%
Pratesi, 2013	81	98.7%	3%	4%	4y: 88%
Wong, 2013	138	94%	10%	3%	5y: 92%
Parlani, 2012	100	95%	7%	3%	5y: 81%

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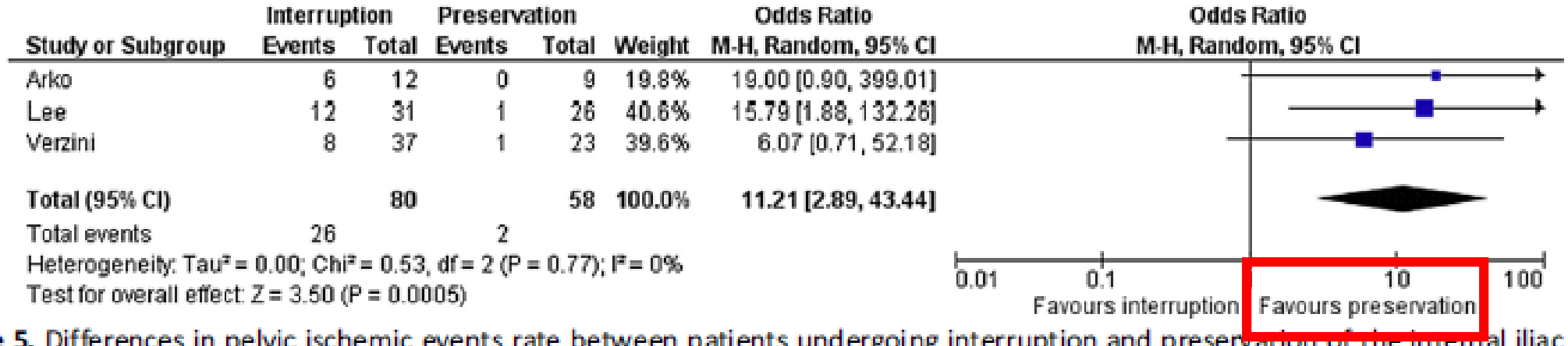
Modern outcomes



Study or Subgroup	Interruption Events	Total	Preservation Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
Arko	6	12	0	9	19.8%	19.00 [0.90, 399.01]
Lee	12	31	1	26	40.6%	15.79 [1.88, 132.26]
Verzini	8	37	1	23	39.6%	6.07 [0.71, 52.18]
Total (95% CI)		**80**		**58**	**100.0%**	**11.21 [2.89, 43.44]**
Total events	26		2			

Heterogeneity: Tau² = 0.00; Chi² = 0.53, df = 2 (P = 0.77); I² = 0%
Test for overall effect: Z = 3.50 (P = 0.0005)

Figure 5. Differences in pelvic ischemic events rate between patients undergoing interruption and preservation of the internal iliac artery during EVAR.

Kouvelos et al, EJVES 2016

No ipsilateral buttock claudication was observed in patients with a patent IBD in the follow-up

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pELVIS Registry

- 10 year multicentre experience
- 575 patients / 650 IBD (95% ZBIS)
- Safe and efficient technique

  technical success 97% (type I EDL)

  low mortality rate
- Secondary procedures mainly related to

  occlusion of EIA/CIA segment (4.6 %)

  type I/III endoleak (4.8%)
- No reintervention for IIA occlusion (1.6%)

Clinical Investigation

JOURNAL OF ENDOVASCULAR THERAPY

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Secondary Procedures Following Iliac Branch Device Treatment of Aneurysms Involving the Iliac Bifurcation: The pELVIS Registry

Konstantinos P. Donas, MD[1,2], Mirjam Inchingolo, MD[1,2], Piergiorgio Cao, MD[3], Carlo Pratesi, MD[4], Giovanni Pratesi, MD[5], Giovanni Torsello, MD[1,2], Georgios A. Pitoulias, MD, PhD[6], Ciro Ferrer, MD[3], Gianbattista Parlani, MD[7], and Fabio Verzini, MD[7], on behalf of the pELVIS Registry collaborators

Abstract

Purpose: To evaluate the incidence and reasons for secondary procedures in patients treated with iliac branch devices (IBDs) for isolated iliac aneurysm or aortoiliac aneurysms involving the iliac bifurcation. **Methods:** Between January 2005 and December 2015, 575 surgical-high-risk patients (mean age 72.0±8.4 years; 558 men) with isolated iliac aneurysms (n=79) or aortoiliac aneurysms involving the iliac bifurcation (n=496) were treated with placement of 650 ZBIS or Gore IBDs (75 bilateral) in 6 European centers. The primary outcome was procedure-related reinterventions for occlusion or high-grade (>70%) stenosis of the bridging device, occlusion of the ipsilateral common or external iliac artery (EIA), type I/III endoleak, rupture, or infection following IBD implantation. Clinical and radiological data were analyzed based on preset definitions of comorbidities, aneurysm morphology, intraoperative variables, and follow-up strategies. **Results:** Nine (1.6%) reinterventions were performed within 30 days for occlusion or endoleak. Among 10 (1.5%) occluded EIAs ipsilateral to a deployed IBD, 6 underwent a reintervention with additional stent placement after thrombolysis (n=4) or a femorofemoral or iliofemoral crossover bypass (n=2). Three of 14 patients with early type I endoleak had a reintervention for an insufficient proximal sealing zone (stent-grafts in 2 common iliac arteries and 1 bifurcated endograft). Mean clinical and radiological follow-up were 32.6±9.9 and 29.8±21.1 months, respectively. Forty-two (7.3%) patients underwent reinterventions in the follow-up period. The overall postoperative reintervention rate was 8.9%. Both external and common iliac segments occluded in 30 (4.6%) IBDs; 2 patients had a crossover bypass and 14 were treated with endovascular techniques. In the other 14 patients, no specific treatment was performed. Seven (1.2%) patients with isolated EIA occlusion were treated during follow-up. Nineteen of the overall 28 patients with type I endoleak underwent endovascular repair. The other 9 were under radiological surveillance due to less significant (<5 mm) sac increase. No reintervention was performed to recanalize 11 (1.6%) occluded internal iliac arteries. **Conclusion:** Midterm experience with placement of IBDs is associated with a low incidence of secondary procedures due to type I endoleaks and occlusions. The main reasons for reinterventions seem to be short proximal sealing zone and poor conformability of the ZBIS device in elongated EIAs.

Keywords

aneurysm, bridging stent-graft, common iliac artery, endoleak, endovascular aneurysm repair, external iliac artery, iliac branched graft, internal iliac artery, occlusion, reintervention, secondary procedure

Introduction

Endovascular aneurysm repair (EVAR) of lesions extending to the iliac bifurcation remains a challenge. Intentional occlusion of the internal iliac artery (IIA) to create a distal landing zone in the external iliac artery (EIA) is a common approach with inherent morbidity (eg, buttock claudication, impotence).[1,2] Endovascular therapy of common iliac artery (CIA) aneurysms using iliac branch devices (IBDs) has become an increasingly popular means of preserving antegrade flow to the IIA.[1] A review of 185 patients treated with an IBD highlighted the safety and feasibility of this modality.[1] However, the incidence of early and late procedure-related reinterventions has not been thoroughly examined.

The aim of the present study was to collect and analyze the secondary procedures necessary during a 10-year multicenter experience with endovascular repair of iliac/aortoiliac aneurysms using IBDs.

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pELVIS Registry

- 10 year multicentre experience
- 575 patients / 650 IBD (95% ZBIS)
- Safe and efficient technique

  technical success 97% (type I EDL)

  low mortality rate

- **Secondary procedures mainly related to**

  occlusion of EIA/CIA segment (4.6 %)

  type I/III endoleak (4.8%)

- **No reintervention for IIA occlusion (1.6%)**

Clinical Investigation

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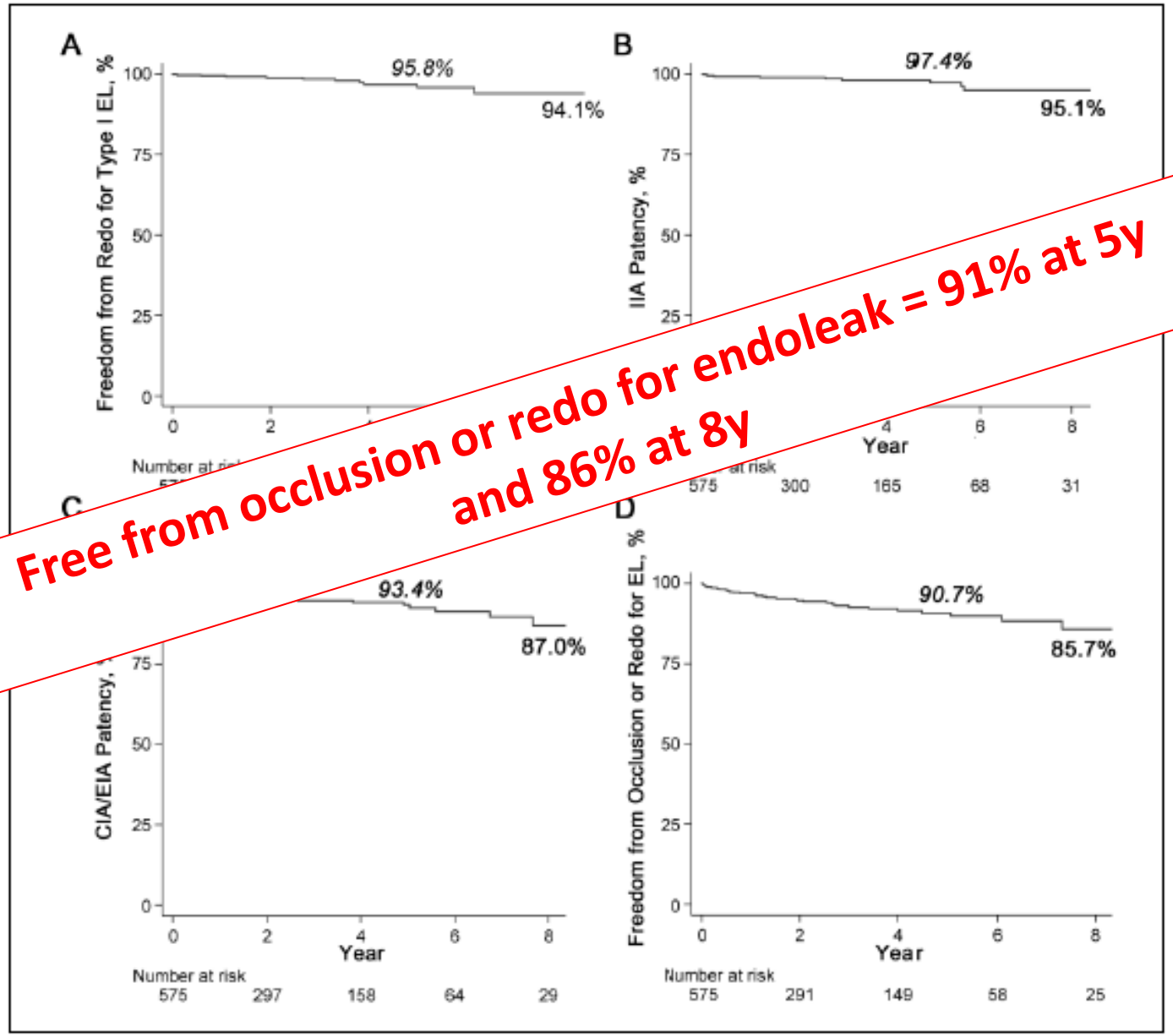
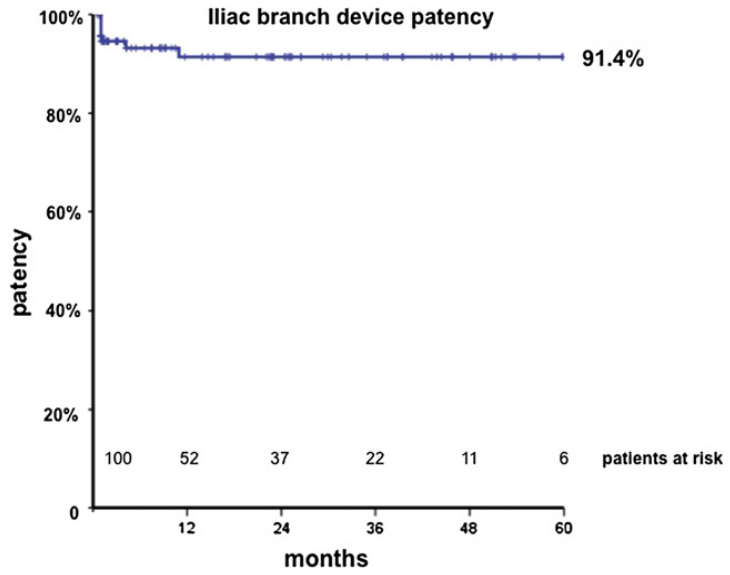
pELVIS Registry



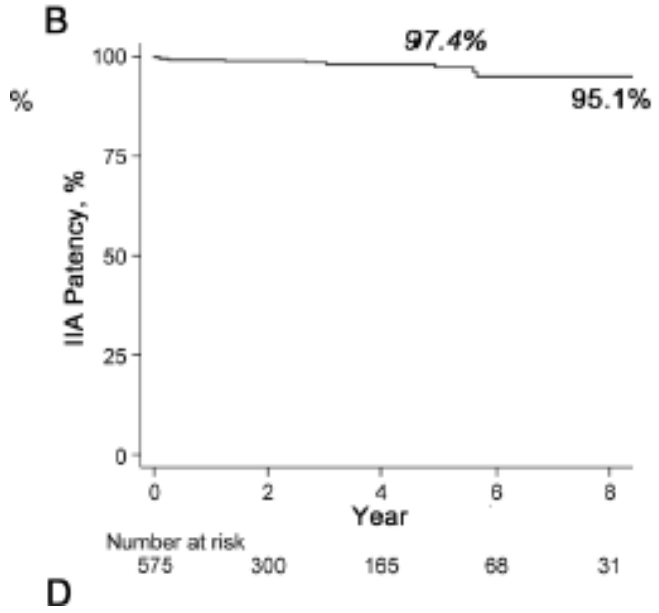
Free from occlusion or redo for endoleak = 91% at 5y and 86% at 8y

Self expandable stent may improve ZBIS conformability in elongated EIA

IIA patency



Parlani et al, EJVES 2012



Donas et al, JEVT 2017

Risks factors associated with occlusions:

- **Occlusive disease in IIA**
- **Procedural time**

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What is the right IIA bridging stent ?

TABLE 3
Respective Outcomes of the Analyzed Studies for Bridging Stent-Grafts Implanted in the Internal Iliac Artery

	N	Follow-up, mo	Occlusions			Occlusions		
			BeSG	<30 Days	>30 Days	SeSG	<30 Days	>30 Days
Malina 2006[2]	10	2 (0.23–32)	10	1	0	0	—	—
Inglott-Serracino 2007[3]	8	6 (1–14)	16	0	2	0	—	—
Haulon 2007[4]	49	14.2*	2	1	0	48	6	0
Naik 2008[5]	2	10†	2	0	0	0	—	—
Ferreira 2010[7]	37‡	(2–31)§	0	—	—	47¶	2	3
Coscas 2010[6]	1	9#	0	—	—	2	0	0
Pua 2011[8]	14	18.7 (6–35)	8	0	0	3	0	0
Donas 2011[9]	64	30.5±20.9	98	0**	0	0		
Total	185		136	2	2	100	8	3

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2012;19:667–671 667

REVIEW

Technical Considerations and Performance of Bridging Stent-Grafts for Iliac Side Branched Devices Based on a Pooled Analysis of Single-Center Experiences

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Department of Vascular Surgery, St. Franziskus Hospital Münster, and Clinic for Vascular and Endovascular Surgery, Münster University Hospital, Münster, Germany.

Purpose: To report a pooled analysis of single-center experiences designed to determine the performance of self-expanding vs. balloon-expandable bridging stent-grafts used in iliac branch devices (IBDs) for the repair of iliac artery aneurysms.
Methods: The English-language literature in the MEDLINE and EMBASE databases was searched for articles published between 2006 and 1 March 2012 on the performance of bridging stent-grafts in the internal iliac artery. Studies were eligible for the analysis if they contained the type of bridging stent-grafts used and the time and cause of any occlusion of the bridging devices. Eight of the 13 studies published between 2006 and 2011 fulfilled the eligibility criteria. The outcome measure was the patency of bridging stent-grafts defined as absence of occlusion of the side branch in the internal iliac artery. Additionally, the performance of the self-expanding stent-grafts vs. balloon-expandable stent-grafts used in conjunction with the IBDs was compared.
Results: In the 8 studies, 100 (42%) self-expanding stent-grafts and 136 (58%) balloon-expandable stent-grafts were placed in 185 patients. Of these 236 bridging stent-grafts, 15 (6%) occluded in 13 (7%) patients: 10 within 30 days after the intervention [2 (1.5%) balloon-expandable and 8 (8%) self-expanding stent-grafts] and 5 beyond 30 days [2 (1.5%) balloon-expandable and 3 (3%) self-expanding stent-grafts]. Symptomatic presentation (hip and/or buttock claudication) of the occluded iliac branch was recorded in 7 of the 13 patients.
Conclusion: The current literature does not support robust conclusions about the performance of bridging endografts of IBDs due to the heterogeneity of the studies. However, the occlusion rate of the bridging stent-grafts was low, especially for balloon-expandable stent-grafts compared to self-expanding devices.
J Endovasc Ther. 2012;19:667–671

Key words: endovascular repair, internal iliac artery, iliac artery aneurysm, iliac branch device, bridging stent-graft, patency, occlusion, self-expanding stent, balloon-expandable stent

Open repair of common iliac artery (CIA) aneurysms can be challenging because of the deep location of the aneurysm, involvement of the internal iliac artery (IIA), obesity, or previous abdominal surgery, leading to hazardous deep venous or ureter injuries.[1] Endovascular repair of CIA aneurysms using iliac branched devices (IBDs) has become

*Konstantinos Donas and Theodosios Bisdas contributed equally to this work.

The authors have no commercial, proprietary, or financial interest in any products or companies described in this article.

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 Available at www.jevt.org

- **236 stents**
- **Low rate of stent thrombosis**
- **Balloon expandable stent : 3%**
- **Self expandable stent : 11 %**

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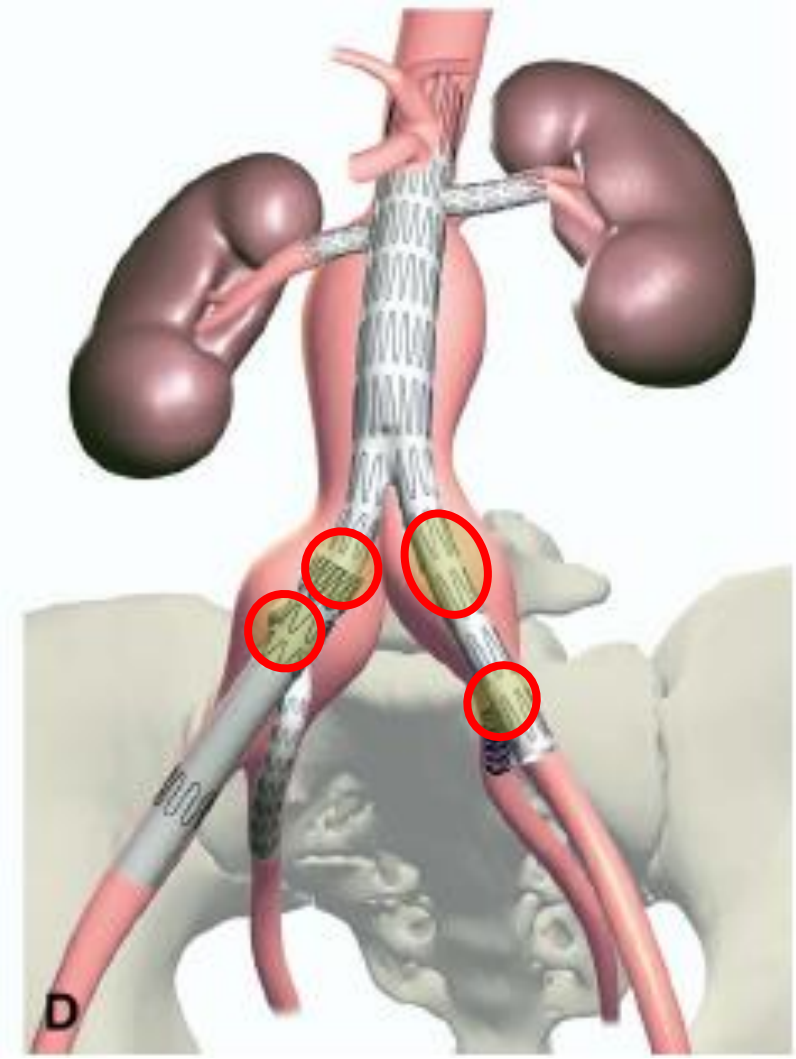
Why not maintain patency to all internal iliac arteries ?

- Not all patients walk enough to claudicate
- Not all patients have a significant risk for spinal cord ischemia
- Increased duration and complexity of the procedure
- Cost
- Late risk: type III endoleak
  - ✓Unilateral branch adds 2 joints
  - ✓Bilateral branch adds 4 joints



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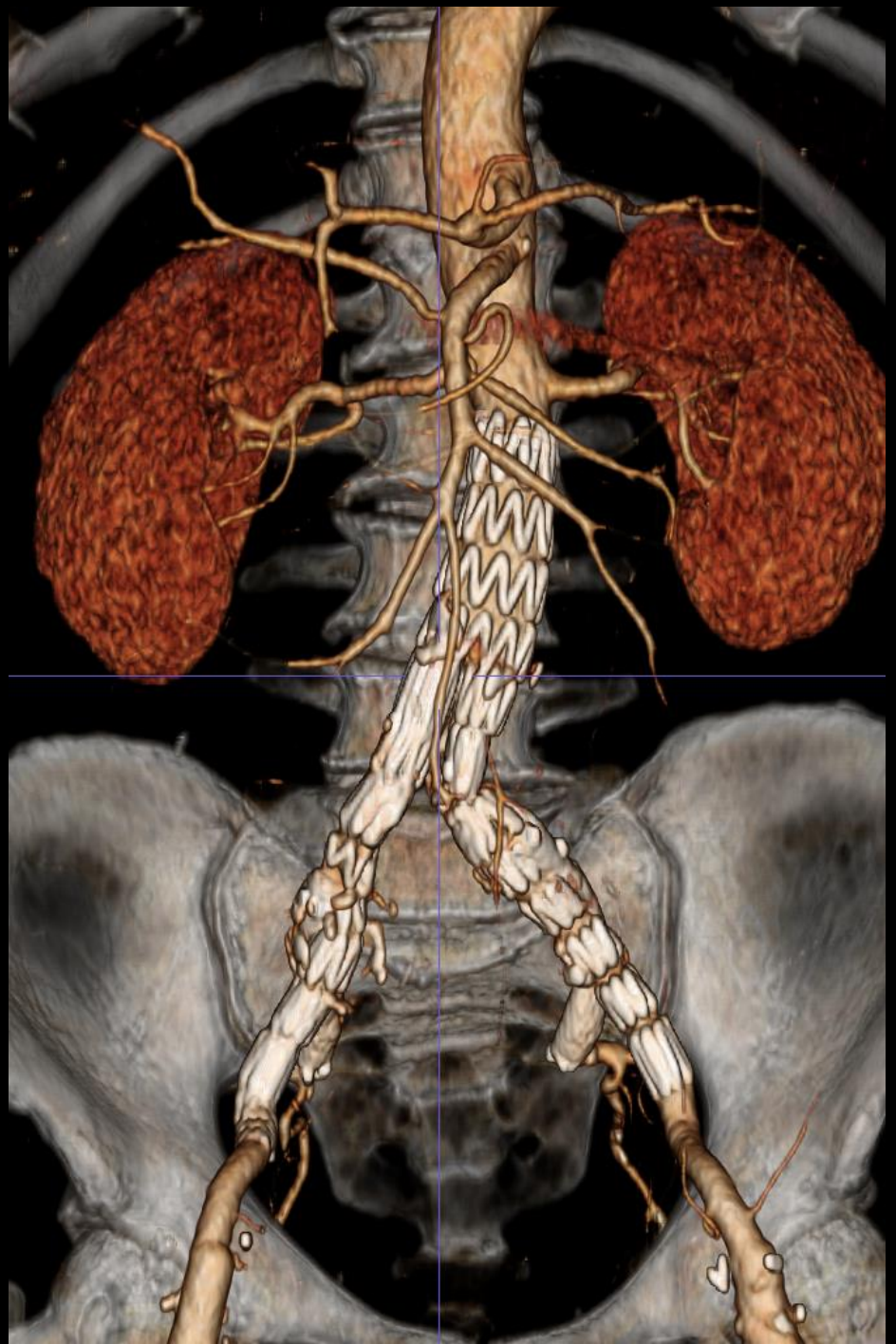

CONCLUSION

The ectatic common iliac should not be ignored

Modern devices provide safe and effective off the shelf options for internal iliac preservation

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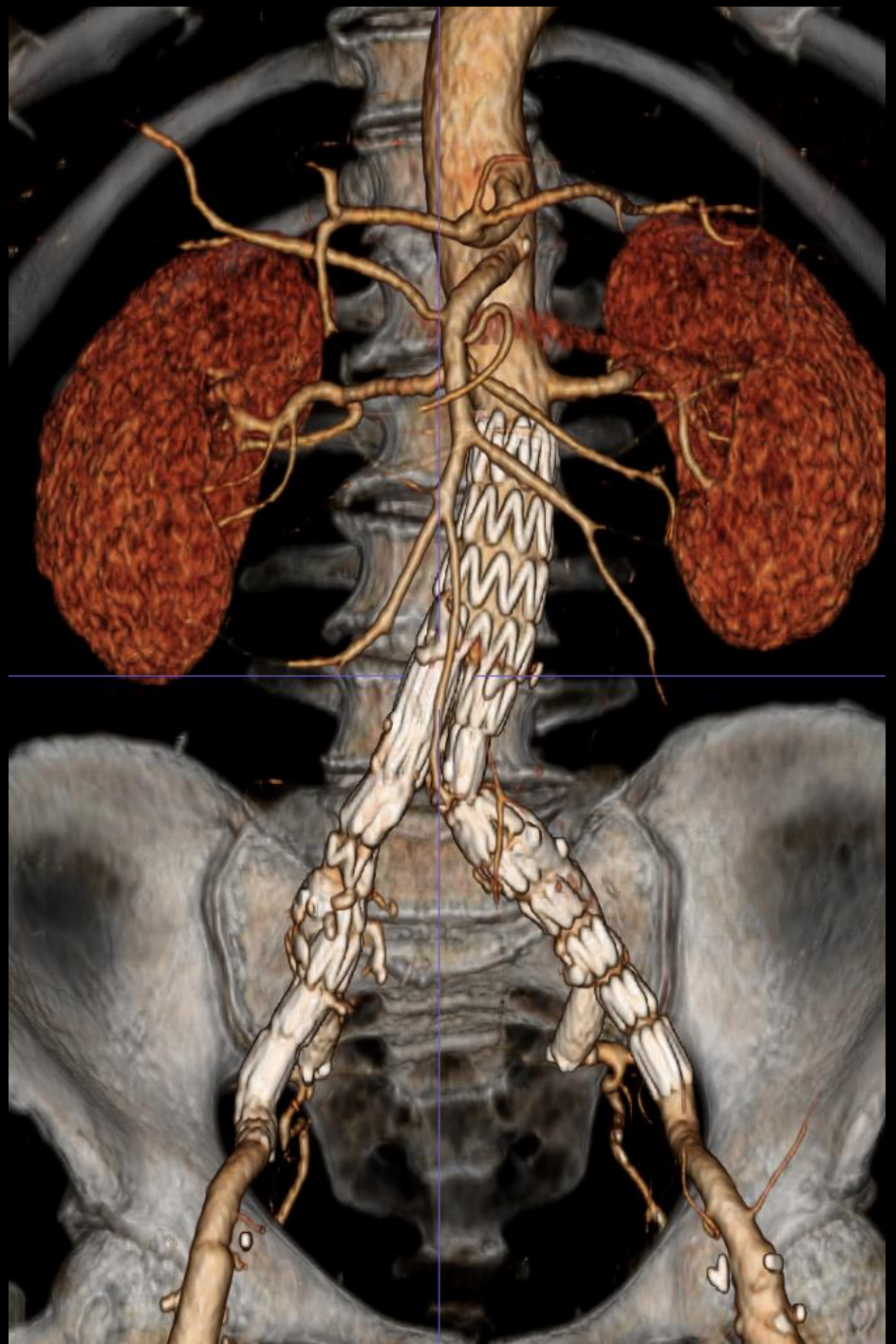

THANK YOU

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