Iliac Branch Graft in the Treatment of Complex Aortoiliac Aneurysms: Early Results from a North American Institution

Uei Pua, MBBS, MMed, Kongteng Tan, MBBS, Barry B. Rubin, MD, PhD, Kenneth W. Sniderman, MD, Dheeraj K. Rajan, MD, George D. Oreopoulos, MD, and Thomas F. Lindsey, MD, MSc

ABSTRACT

Purpose: To describe early experience with the use of iliac branch grafts (IBGs) in aortoiliac aneurysm repair.

Materials and Methods: From July 2007 to August 2009 (25 months), 14 patients (13 men, one woman) with a mean age of 70.1 years (range, 59.3–80.0 y) were treated with IBGs. Indications were abdominal aneurysm with common iliac artery (CIA) involvement (n = 11), juxtarenal aortic aneurysm with CIA involvement (n = 1), and bilateral CIA and internal iliac artery (IIA) aneurysms (n = 1). Postoperative endoleaks and patency rate were determined with computed tomography within 1 month of implantation and 1 year thereafter, with concurrent clinical evaluation for pelvic ischemia. Mean follow-up period was 18.7 months (range, 6–35 mo).

Results: Technical success rate, as defined by successful implantation of IBG with no intraprocedural type I or type III endoleak, was 86% (12 of 14). A total of 14 IBGs were successfully deployed in 12 patients. Two cases of technical failure were related to excessive iliac tortuosity. The mean hospitalization duration was 6.5 days (range, 3–14 d), with zero mortality at 30 days. There were two cases of type II endoleak treated conservatively and a single case of IBG-related type III endoleak that required repeat intervention. The rest of the stent-implanted aortic and iliac aneurysms remained stable in size, with no aneurysm rupture or death recorded. All stent-implanted iliac branches remained patent on follow-up. None of the patients who received IBGs had new symptoms of pelvic ischemia.

Conclusions: Iliac branch graft placement is a feasible technique with excellent short-term results in the treatment of aortoiliac aneurysms.

ABBREVIATIONS

AAA = abdominal aortic aneurysm, CIA = common iliac artery, EIA = external iliac artery, EVAR = endovascular aortic aneurysm repair, IBG = iliac branch graft, IIA = internal iliac artery

Endovascular aneurysm repair (EVAR) of abdominal aortic aneurysms (AAAs) has gradually replaced open surgical repair in patients deemed to be at high risk, and its use has reduced aneurysm-related deaths in patients with AAAs (1,2). However, the general utility of conventional EVAR is often constrained by unfavorable anatomy, particularly issues related to fixation sites or landing zones.

One of the anatomic challenges of conventional EVAR is the presence of common iliac artery (CIA) aneurysm, which presents a problem in the achievement of an effective seal and distal fixation. Although iliac aneurysms occurring in isolation are rare—with a prevalence of only 0.03% (3)—unilateral or bilateral iliac artery aneurysm or ectasia can be present in as many as 40% of cases of AAA (4,5). It is accepted that, when the size of the CIA aneurysm exceeds 24 mm, achieving an effective seal of the distal fixation with conventional EVAR devices is extremely difficult, if not impossible (4,5). The traditional endovascular treatment in such cases entails sacrificing the internal iliac artery (IIA) by means of embolization, followed by endografting into the external iliac artery (EIA). However,

From the Department of Diagnostic Radiology (U.P.), Tan Tock Seng Hospital, 11 Jalan Tan Tock Seng, Singapore 308433; Division of Vascular and Interventional Radiology, Department of Medical Imaging (U.P., K.T., K.W.S., D.K.R.), Toronto General Hospital, University Health Network; and Division of Vascular Surgery (B.B.R., G.D.O., T.F.L.), University of Toronto, Toronto, Ontario, Canada. Received July 3, 2010; final revision received December 18, 2010; accepted January 1, 2011. Address correspondence to U.P.; E-mail: druei@yahoo.com

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such sacrifice of the IIA is not entirely benign, and pelvic ischemic symptoms can occur; they are more severe in bilateral IIA occlusion. For instance, with unilateral IIA occlusion, self-limiting buttock claudication can occur in the presence of good collateralization. However, more severe complications such as colonic or spinal ischemia can occur with bilateral IIA occlusion. The reported incidences of ischemic symptoms with IIA occlusion range from 12% to 45%, with unilateral occlusions in the lower end of the spectrum (6–10).

The iliac branch graft (IBG) is a novel iliac extension limb that has a side branch for cannulation and stent implantation of the IIA. It is designed primarily to be used with aneurysmal CIA to allow endografting to be extended into the EIA for effective distal fixation, at the same time preserving antegrade flow to the IIA.

The purpose of this retrospective study is to evaluate the technical feasibility and short-term patency rate of IBGs based on the authors' institution's experience.

MATERIALS AND METHODS

Included in this report are consecutive patients who received IBG implantation in a tertiary academic center in North America. The device used was a commercially available device approved for use in Ontario, Canada. This retrospective clinical investigation was approved by our institutional review board, with waiver of informed consent. The patients were identified from our institutional EVAR database and retrospectively studied. Clinical data were retrieved from the hospital's electronic medical records, and imaging data were retrieved from picture archiving and communication systems (version 2.0; FUSION Efilms; Merge Healthcare, Milwaukee, Wisconsin).

Patients and Demographics

The patients were identified from our institutional EVAR database, from the time of inception of our advanced EVAR program in July 2007 to August 2009. All were referred primarily for the treatment of aortoiliac aneurysms. Contrast-enhanced computed tomographic (CT) aortograms were obtained in all patients and used for preoperative planning. Patients were selected by consensus between vascular surgeons and interventional radiologists during the institution's weekly vascular meetings. All patients were considered to be at high risk in the setting of open surgical repair and had aneurysms that were unfavorable for conventional EVAR. Our institutional criteria for treatment of AAA are based on the largest diameter on CT being greater than 5 cm in women and greater than 5.5 cm in men. Patients with CIA aneurysms larger than 2.5 cm—regardless of AAA size—were also treated. The patient and disease characteristics are summarized in the **Table**.

The selection for treatment with an IBG was done based on the activity level of the patient and the anatomic criteria of the CIA aneurysm (diameter $>$ 24 mm). Our absolute exclusion criteria are severe atherosclerosis of the IIA and small CIA diameter of less than 18 mm at the level of the bifurcation. The latter is a result of a minimum CIA diameter of 18 mm required for in vivo opening of the side branch from the constrained device.

Device and Deployment

The Zenith iliac branch device (Cook, Bloomington, Indiana) is a second-generation IBG that is a two-branched vessel graft consisting of a main iliac limb with an additional reinforced stump for the IIA side branch (**Fig 1**). The IBG has a fixed proximal diameter of 12 mm and distal diameter of 10 or 12 mm, common iliac segment length of 45 or 61 mm, and EIA segment length of 41 or 58 mm. iCAST (Atrium, Hudson, New Hampshire), VIABAHN (W.L. Gore and Associates, Flagstaff, Arizona), and Fluency (Bard Peripheral Vascular, Tempe, Arizona) stents were used to bridge into the IIA in eight, two, and one case, respectively. Implantation techniques were similar to those described in the literature (11,12).

Follow-up Protocol

In uncomplicated cases, CT aortograms were obtained within the first month after implantation and annually thereafter per our institutional EVAR protocol. Clinical reviews were performed quarterly for the first year and biannually thereafter.

Study Endpoints and Definitions

Technical success was defined as successful implantation of the IBD in the intended iliac vessels, exclusion of the iliac aneurysms with preservation of antegrade flow to the IIA tributaries, and lack of type I or type III endoleak on immediate postimplantation angiograms.

Clinical variables recorded included patient age, sex, aneurysm location and size, aortoiliac interventions, and repeat intervention. Major complications are defined as events with clinical consequences that necessitated additional procedures or inpatient hospitalization. Imaging evidence of graft patency, endoleaks, or any form of graft dysfunction was recorded.

RESULTS

From July 2007 to August 2009 (25 months), 14 consecutive patients (13 men, one woman) with a mean age of 70.1 years (range, 59.3–80.0 y) met the inclusion criteria and underwent IBG implantation. Indications were AAA with CIA involvement (n = 11; five with predominant CIA aneurysms $>$ 2.5 cm), juxtarenal aortic aneurysm with CIA involvement (n = 1), and bilateral CIA and IIA aneurysms (n = 1). The mean diameters of the AAAs and CIAs were 6.0 cm (range, 3.4–8.7 cm) and 3.9 cm (range, 3.4–5.7 cm), respectively. Retrospective analysis of the postimplan-