# Preservation of the Internal Iliac Arteries with Branched Iliac Stent Grafts (Zenith Bifurcated Iliac Side): 5 Years of Experience

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**Background:** The extension of the aneurysmal disease to the iliac bifurcations is one of the limits of the endovascular treatment of aortoiliac aneurysms. The Zenith Bifurcated Iliac Side (ZBIS®) stent graft (Cook Medical) is a branched stent graft making it possible to preserve the internal iliac arteries (IIAs) using a totally endovascular procedure.
**Methods:** The purpose of this monocentric retrospective study was to analyze the results of the ZBIS stent graft among patients presenting aortoiliac aneurysms extending to the iliac bifurcation treated between January 1st, 2010 and January 1st, 2015 in the department of vascular surgery of the University Hospital of Toulouse.
**Results:** A total of 26 ZBIS stent grafts were implanted in 25 patients. The perioperative mortality was null, and the technical success rate was 96% (24 of 25). The median duration of follow-up was 29 months (1−60). Mortality rate at 30 days was null. The rate of early complications was 4% (1 of 25), with only one early reintervention for acute ischemia. Patency rate at 30 days was 96.1% (25 of 26) with 1 type 1a endoleak observed with 1 aortobi-iliac stent graft. The midterm patency rate without endoleak was 94.7% (18 of 19), with 2 patients presenting a persistent buttock claudication due to the embolization of the IIA.
**Conclusions:** The ZBIS stent graft makes it possible to exclude aortoiliac aneurysms by endovascular route, whereas preserving the IIA with satisfactory results in the short and medium term. The careful study of the preoperative quality of the IIAs and the respect of the "Instructions for Use" made it possible to obtain a very satisfactory patency rate.

## INTRODUCTION

The treatment of the abdominal aortic aneurysms (AAAs) extending to the iliac arteries by conventional surgery is accompanied by a morbimortality justifying the development of endovascular techniques and their evaluation.

The endovascular alternative initially consisted in extending the distal zone of anchoring in the external iliac artery (EIA) after the preliminary embolization of the internal iliac artery (IIA) to avoid a type 2 endoleak.[1] Some literature data suggest that the preservation of at least 1 IIA during the endovascular exclusion of the aortoiliac aneurysms which extend to the iliac bifurcation could limit the incidence of pelvic ischemia.[2] According to the studies, the unilateral or bilateral embolization of the IIAs is accompanied by pelvic ischemic complications in 25−55% of the cases. The most frequent complications are buttock claudication (up to 42% after bilateral embolization) and erectile dysfunction (very variable incidence according to the studies: 4−45%). An infrequent but much more serious complication is colic ischemia and spinal cord ischemia (0.21%).[3−5]

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Currently, various techniques make it possible to preserve the IIAs during the endovascular exclusion. The hybrid techniques such as the ''banana technique'' or the ''reverse *U* stent'' consist in placing a stent from the EIA toward the IIA in association with a contralateral aortomono-iliac stent graft after embolization of the IIA. Techniques of surgical revascularization of an IIA associated with the distal anchoring of a stent graft in the EIA are also available, but the surgical stage limits the mini-invasive character of the endovascular procedure.

Three purely endovascular techniques were described: the ''Bell-Bottom'' technique,[6,7] the ''chimney-graft'' technique,[7] and iliac branched stent grafts like the Zenith Bifurcated Iliac Side (ZBIS®; Cook Medical) or the Helical Branch Endograft (HBE®, Cook Medical).[8] The purpose of this study was to analyze the postoperative and midterm results of the endovascular treatment with ZBIS branched iliac stent grafts to treat the aortoiliac or common iliac aneurysms extending to the iliac bifurcation.

## MATERIALS AND METHODS

We studied in a retrospective way a cohort of 25 patients treated in the department of vascular surgery of the university hospital center (CHU) of Toulouse for an aortoiliac or common iliac aneurysm extending to the iliac bifurcation.

The indications for the treatment with a ZBIS stent graft were:

- The need for excluding at least 1 of the 2 IIAs, using a ZBIS stent graft even in the cases where the contralateral IIA was conserved in the event of a favorable anatomy with a good downstream bed, in particular gluteal,
- The presence of an unilateral or bilateral aneurysm of the common iliac artery (CIA) $>$ 30 mm in diameter,
- The presence of an aneurysm of the CIA $>$ 25 mm in diameter associated with an AAA $>$ 50 mm in diameter,
- Anatomic criteria allowing the use of this stent graft (CIA $\geq$ 45 mm in length, diameter of the iliac bifurcation of at least 17 mm, IIA presenting a distal neck $>$ 15 mm in length with a good downstream bed, diameter of the IIA between 6 and 12 mm, tortuosity of the iliac arteries),
- A high surgical risk appreciated on age and comorbidities criteria (age $\geq$ 80 years, coronary disease (previous myocardial infarction or angina) with positive functional test and coronary lesions for which revascularization is impossible or not indicated, cardiac failure with obvious clinical demonstrations, inoperable tight aortic valve stenosis, left ventricular ejection fraction $<$40%, chronic respiratory insufficiency objectified by a maximum expiratory flow rate (MEFR) $<$1.2 L/sec, a vital capacity $<$50% of the predicted value according to the age, the sex, and the weight, an analysis of blood gases in absence of oxygen with $PaCO_2$ $>$45 mm Hg or $PaO_2$ $<$60 mm Hg, and an oxygen therapy at home.

Impaired renal function was defined by a glomerular filtration rate $<$ 30 mL/min estimated by the Modification of Diet in Renal Disease study group formula. The patients having an obstructive chronic bronchopneumopathy were defined by a MEFR/tidal volume ratio $<$70% after administration of bronchodilator.

All the patients were operated in the operating room on a carbon-floating table using an OEC 9,900 General Electric motorized image intensification unit. The technical success of the procedure was defined as the patency of the endovascular assembly without type 1 or 3 endoleak on the perioperative control arteriography. The follow-up protocol consisted in a visit at 2 months, 6 months then every year associated with an imaging study by abdomino-pelvic echo-Doppler and/or angio computed tomography.

## RESULTS

Twenty-four patients were operated for an AAA associated with an aneurysm of the CIA. Only one was operated for an isolated aneurysm of the CIA. Among the 25 patients with exclusion of an aortoiliac or common iliac aneurysm extending to the iliac bifurcation, 1 patient was treated with bilateral ZBIS stent grafts. This patient presented with an aortobi-iliac aneurysm extending to the 2 iliac bifurcations but respecting the IIAs. The anatomy of this patient was particularly favorable for the preservation of the 2 IIAs with ZBIS stent grafts. The characteristics of the patients are summarized in Table I.

### Thirty-Day Results

The technical success rate was 92% (23 of 25). The first case of technical failure was because of the perioperative occlusion of the internal iliac limb of the ZBIS stent graft occurring when the module was connected with the aortobi-iliac stent graft, in relation with a conflict between the internal iliac stent,