INTRODUCTION

The aortic bifurcation and iliac vessels are common sites of atherosclerotic occlusive disease; the chronic and progressive obstruction was described by the French surgeon Rene Leriche, whose name it bears until today as “Leriche’s syndrome” [1]. The advancing age of the population move the definition from a syndrome to complex aorto-iliac occlusive lesions and the current guidelines recommend to treat the syndrome by surgical or endovascular revascularization depending on the complexity of the disease [2]. The surgical restoration of vascular continuity to the lower extremity for the treatment of aortoiliac occlusive disease in the setting of a septic groin remains a serious challenge to vascular surgeons [3].

Currently this problem may be solved through an “in situ” reconstruction with an autologous femoral vein, cryopreserved allograft or antibiotic impregnated synthetic grafts [3,4]. A relatively uncommon but feasible option to restore the flow and preserve the limb is the extra-anatomic reconstruction with obturator foramen bypass [3-5]. This surgical approach was first described in 1963 by Shaw and Baue [6], as an extra-anatomic lower extremity bypass to avoid a hostile groin. We herein present a 65-year-old male with Leriche’s syndrome that underwent an aorto-bifemoral reconstruction through a right obturator foramen to the distal right superficial femoral artery (SFA).
CASE

The patient is a 65-year-old male with a history of type 2 diabetes mellitus, dyslipidemia, coronary artery disease, morbid obesity and aortobiiliac occlusive disease who in 2006 experienced progressive and severe bilateral buttck and lower extremity claudication. At that time, a magnetic resonance angiography (Fig. 1), revealed an occlusion of the infra-renal aorta and both iliac arteries, and he underwent a left axillo-femoral bypass and left to right femoral-femoral crossover bypass at another hospital. Two years later, in January 2008, he was referred to our institution for evaluation of a graft-associated infection in the right groin and worsening lower extremity ischemia; wound cultures showed Escherichia coli and Enterobacter. Following the initiation of antimicrobial therapy, preoperative imaging, and medical optimization, we excised the infected graft and decided to perform an aortobifemoral reconstruction with an extra-anatomic route through the obturator membrane on the right side. The aorta was exposed via transperitoneal approach and a suprarenal clamping was obtained. The aorta was opened longitudinally at the level of the renal arteries; and an endarterectomy and aortoplasty were completed. Subsequently, the clamp was repositioned to the infrarenal location. From the aortic stump, an end-to-end anastomosis was completed using an 18x9 mm bifurcated Dacron graft (Fig. 2A). The left limb was tunneled in the retroperitoneum and driven to the groin for an end-to-side anastomosis with the common femoral artery. From the right side we followed the hypogastric artery to the obturator artery which led us to the obturator membrane; the anterior border was our landmark to pass the tunneler through the membrane. The tunnel between the inflow and target arteries was made in the space between the adductor longus and brevis muscles anteriorly, and the adductor magnus muscle posteriorly. The tunneler passed through the tunnel in retrograde fashion from the incision in the most distal third of the leg that allowed us to expose the SFA in the Hunter’s canal, where we completed an end-to-side anastomosis (Fig. 2B). Computed tomography angiography with three-dimensional (MRA-3D) reconstruction. Antero-posterior (A) and right lateral (B) views revealed complete occlusion of the infrarenal aorta and common iliac arteries bilaterally (white hollow arrows in A and B).

Fig. 1. Magnetic resonance angiography with three-dimensional (MRA-3D) reconstruction. Antero-posterior (A) and right lateral (B) views revealed complete occlusion of the infrarenal aorta and common iliac arteries bilaterally (white hollow arrows in A and B).

Fig. 2. (A) An aorto-bifemoral reconstruction was performed via transperitoneal approach. (B) The right graft limb was anastomosed to a 9 mm Dacron graft for end-to-side anastomosis with the distal superficial femoral artery.
angiography with three-dimensional reconstruction demonstrated the patent aorto-bifemoral graft (Fig. 3A). The patient recovered well from the surgery and he was discharged home in stable condition following wound debridement, intravenous antibiotics and appropriate care. Six years later in July 2014, he started complaining of right lower extremity claudication, and imaging showed right limb occlusion, his ankle-brachial index (ABI) was abnormal in that extremity. We first attempted an open thrombectomy without success; subsequently we decided to perform an interposition graft from the proximal portion of the right aortobifemoral limb to the femoral graft in an end-to-end fashion through the healed groin (Fig. 3B). The patient recovered well from the surgery, his claudication symptoms resolved and the right lower extremity ABI increased from 0.5 to 0.9.

**DISCUSSION**

No arguments exist in regard to the complex and serious nature of groin sepsis with a reported mortality rate of 17% and amputation rates as high as 41% [7]. Standard surgical approaches have stressed the need for a complete removal of the infected graft and the revascularization of the extremity. In the present case, we looked for the obturator foramen route to restore flow, due to the infected groin; we considered the obturator bypass as an appropriate option because it was deep and distant from the infected area and provided the shortest possible distance bypass and a good outflow. This technique is not novel, but it is relatively uncommon these days and often overlooked for the variety of newer and more fashionable treatment options such as in situ graft replacement with autologous veins when possible, cryopreserved allografts or antibiotic-impregnated materials [5]. However, we agree that obturator bypass represents one of the best time honored treatment options when complex infections occur in the groin [5]. The literature reports have suggested that obturator bypass is safe, effective and durable method with primary patency rates of 76% at 24 months in clinical series [3,8-10]. In addition, the literature regarding mortality rates ranges from 0% to 17% [11]. Other types of extra-anatomic options to avoid the groin include axillo-femoral or ilio-lateral femoral or popliteal bypasses; however, they have less favorable long-term patency than the obturator foramen bypass [3].

In Table 1, we summarize a contemporary review of the clinical outcomes since 2002 with this surgical technique in different clinical settings such as septic groin, infected vascular grafts and malignancies [3-5,7-14].

This report particularly illustrates and emphasizes the safety and efficacy of the obturator bypass for avoiding infected sites in the presence of a septic groin, for the preservation of limbs, and for allowing groin healing in a high risk patient. Additionally, although three cases of bilateral aorto-bifemoral obturator foramen bypass are available in the literature [4,5,12], the long-term data regarding its durability remains limited. This case demonstrated a secondary patency rate of 78 months.
Table 1. Summary of the outcomes in contemporary clinical series and cases reports with the use of obturator foramen bypass

| Author | Year | Patient no. | Indication for obturator bypass (patient no.) | Bypass configuration (patient no.) | Morbidity/mortality | Clinical outcomes | Follow-up |
|--------|------|-------------|-----------------------------------------------|-----------------------------------|---------------------|-------------------|-----------|
| Patel et al. [3] | 2002 | 12 | Graft infection (9) Groin infection secondary to catheterization (3) | Obturator bypass from ABF to SFA (8) Native iliac to SFA (3) Iliac to popliteal arteries (2) ABF limb to popliteal (1) | 2 deaths (17%) 4 major complications requiring reoperation (33%) | Complete wound healing in 10 patients (83%) | 37 months Graft patency 60% Limb salvage 80% |
| Matousevitch et al. [8] | 2007 | 8 | IVDU through femoral vessels | Iliac to popliteal arteries (8) Graft material: Cryopreserved graft (3) Alloplastic grafts (5) | 2 early thromboses (25%) 1 lower extremity amputation (12.5%) | Complete healing in all patients (100%) | 40 months Graft patency 75% at one month |
| Kim and Joh [5] | 2005 | 1 | Graft infection | ABF obturator bypass (bilateral) Graft material: Dacron | None | Complete wound healing | 20 months Graft patent |
| Thompson et al. [4] | 2006 | 1 | Graft infection | ABF obturator bypass (bilateral) Graft material: ePTFE | None | Complete wound healing | 24 months Graft patent |
| Haleem [9] | 2006 | 24 | Infected aortic graft (4) Femoral graft infection (8) Pseudoaneurysm (4) Crush injuries (4) IVDU through femoral vessels (2) Iatrogenic (2) | Configurations: not reported Graft material: Dacron | 2 reinterventions (8%) 1 death (4%) 1 major amputation (4%) | Complete wound healing in all patients (100%) | 28 months Patency rate 29% |
| Kim et al. [12] | 2007 | 1 | Septic hip/infected graft | ABF obturator bypass (bilateral) to popliteal arteries | None | Wound healing | NR |
| Ferreira et al. [10] | 2008 | 5 | Penile squamous cell carcinoma (5) | Iliac-SFA (2) Iliac-popliteal (3) Iliac-femoral (4) Graft material: Dacron (4), SVG (1) | None | Allowed completed resection of extensive tumors | 12 months 4 deaths secondary to pulmonary metastasis (3), one MI |
| Rabbani et al. [14] | 2008 | 9 | Infected femoral Pseudoaneurysms | 10 obturator bypasses Iliac-popliteal (6) Iliac-femoral (4) Graft material: ePTFE (8), SVG (1) | 1 death (11%) 2 forefoot amputation (22%) | Allowed revascularization of the limbs | NR |
| Ruangsetakit et al. [13] | 2012 | 3 | Infected femoral Pseudoaneurysms | Iliac-popliteal artery bypass Iliac-femoral Aorto-femoral Graft material: PTFE (2), Dacron (1) | None | Complete wound healing | Mean follow up 35 months All grafts were patent. |
| Busch et al. [11] | 2013 | 2 | Groin infection (1) IVDU through femoral vessels (1) | Iliac-SFA (2) Graft material | 1 hemorrhage (50%) | Complete wound healing | Both bypasses remain patent at 32 and 12 months. |

ABF, aortobifemoral; SFA, superficial femoral artery; IVDU, intravenous drug use; ePTFE, polytetrafluoroethylene; MI, myocardial infarction; SVG, saphenous vein graft; NR, not reported.
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