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Customized femoral vein grafts for inferior vena cava reconstruction

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After extended en-bloc resection of a retroperitoneal neoplasm, prosthetic grafts can efficiently replace the inferior vena cava. However, in cases of concomitant biliary or bowel surgery, there is a risk of infection, and autogenous materials typically used present with size match. We present a method of autogenous graft construction using the femoral vein for replacement of the inferior vena cava, with an alternate configuration for renal vein implantation. (J Vasc Surg: Venous and Lym Dis 2014;2:200-3.)

Involvement of the inferior vena cava (IVC) has long been considered a limiting factor for the resection of retroperitoneal tumors. While en bloc multivisceral resection, including a segment of the IVC, has been proposed in selected patients to achieve complete tumor excision,[1,2] there is still controversy regarding the need and technique for reconstruction following IVC resection. For cases of extended involvement, some authors have proposed IVC ligation without reconstruction. Others have advocated complete resection followed by reconstruction using prosthetic material.[3,4] When radical resection also involves a biliary procedure or bowel resection, however, the risk of prosthetic graft infection becomes a serious concern, and autogenous material may be favored.[5] Few successful cases of autogenous replacement of the IVC have been reported, mainly because the size match between graft and IVC makes surgery challenging.[6-12]

We present a method of IVC replacement with a custom-made autogenous graft using the femoral vein (FV), with two representative cases. The first shows an infrarenal replacement; the second shows reimplantation of a renal vein onto the graft using an alternate configuration.

CASE REPORT

Operative procedure: General outline. Procedures were performed by experienced surgeons after consulting with a multidisciplinary cancer team and receiving the patient's written consent. Surgery was proposed in order to obtain negative surgical margins. Preoperatively, clinical examination and Duplex scanning of both lower limb vessels was performed to rule out a bifid FV, occlusive lesions, or venous insufficiency and to assess the diameters of the FV (minimal size, 5 mm). All patients were operated on under general anesthesia in the dorsal decubitus position, with one lower extremity abducted on the operated side. The operative technique began with exploration of the abdomen and tumoral en bloc resection by the visceral or urological team. As soon as resectability and risk of contamination were confirmed, the vascular team started harvesting 18 to 20 cm of the FV from the thigh (below the profunda femoris vein), through an incision that extended from the traditional incision points of the common femoral and above-knee popliteal vessels, as thoroughly described elsewhere in the literature.[13] In particular, the sartorius muscle was reflected laterally at the upper part of the incision and medially at the distal part of the incision. The graft was then customized in order to match the patient's anatomy and interposed between two healthy segments of the IVC. This vascular step should precede visceral reconstruction, if necessary. No temporary arteriovenous fistula was created. Finally, aspiration drainage was placed in the abdominal and thigh incisions before closure. Postoperative prescriptions included 4000 UI of enoxaparin daily for 15 days (in order to prevent venous thromboembolism) and elastic stockings on the operated lower limb for 3 months. Both patients were discharged to home.

Configuration 1: Infrarenal replacement. The patient was a 45-year-old man who had undergone right orchiectomy and adjuvant chemotherapy for a testicular teratoma 15 years prior. In the context of sudden abdominal pain, an abdominal computed tomography (CT) scan showed a retroperitoneal 7.5-cm tumor involving the right kidney, the head of the pancreas, and the IVC (Fig 1, *A*). A CT-guided biopsy confirmed that the mass was a metastatic development of the testicular teratoma. The team of visceral surgeons began en bloc resection with cephalic duodenopancreatectomy and right nephrectomy. Complete resection was achieved by removing a 9-cm-long segment of infrarenal IVC and the affluent right renal vein. The vascular surgeons created a 2-cm diameter and a 9-cm-long tube graft with the harvested FV. The FV was opened longitudinally, then divided into two rectangular pieces of 3 × 9 cm, which were ultimately joined by two side-by-side continuous sutures (5-0 Prolene). The customized graft was

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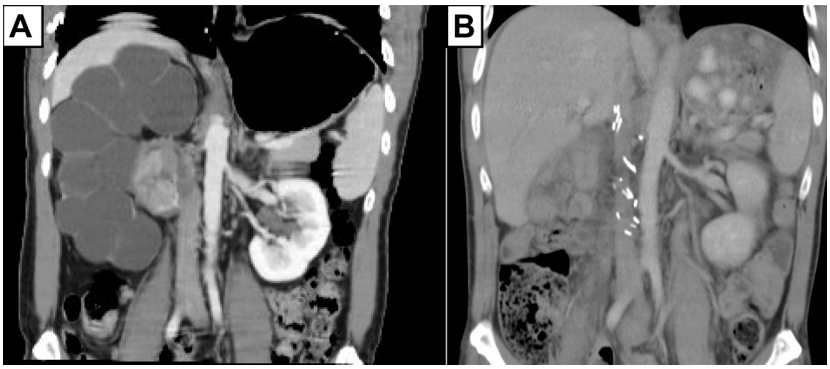

Fig 1. Configuration 1: Abdominal computed tomography (CT) angiogram. **A,** At the time of diagnosis, with a retroperitoneal tumor mass involving the inferior vena cava (IVC). **B,** At 1-year follow-up, with a patent vein graft.

then interposed between two segments of the IVC, with continuous suture (Fig 2). The total duration of the procedure was 435 minutes. No transfusion was required perioperatively. A pancreatic fistula occurring during the hospitalization period was successfully managed nonoperatively without any prolonged infectious complications. The patient recovered with a patent IVC at discharge (day 15) and at 1-year follow-up (Fig 1, *B*). His lower limb remained asymptomatic, without any leg swelling or signs of venous insufficiency.

Configuration 2: Perirenal replacement. The patient was a 71-year-old woman presenting with low back pain. A CT scan showed a retroperitoneal 8-cm tumor involving the right kidney, the right renal vein, and the perirenal IVC. There were also osteolytic lesions in T8 and the left iliac bones, as well as non-neoplasic cystic lesions in the liver. The patient was eligible for en bloc tumoral resection followed by adjuvant chemotherapy. The urologists commenced the procedure with radical nephrectomy. They encountered a 2-cm tumor affecting the transverse colon and the right liver, which was resected by the general surgeon, while the team of vascular surgeons began harvesting the FV. Once en bloc resection was achieved and the colon repaired, the IVC was reconstructed with the FV-customized graft as described in configuration 1 (Fig 2). In this particular case, the suture lines were intentionally oriented side-by-side, and the left continuous suture was interrupted in order to leave a hole to receive the left renal vein (Figs 2, 3). The total duration of the procedure was 320 minutes. Perioperatively, 600 mL of red blood cell were transfused. The patient was discharged home at day 8,

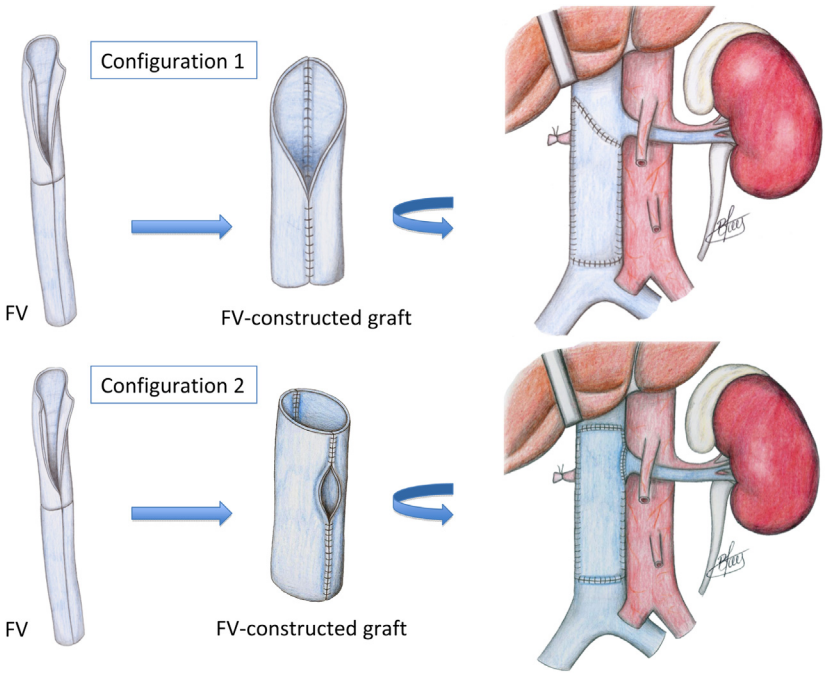

Fig 2. Artistic views of the venous reconstruction in configurations 1 and 2: The harvested femoral vein (*FV*) was opened longitudinally, and the graft was constructed so as to match the patient's anatomy.

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