A new technique for reconstruction of the aortic bifurcation with saphenous vein panel graft

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A 60-year-old male patient presented with a false aneurysm of the common iliac artery and methicillin-resistant *Staphylococcus aureus* septicemia complicating previously placed kissing covered stents of the aortic bifurcation. We removed the prosthetic material and repaired the aortic bifurcation with a composite saphenous vein panel graft. To our knowledge, this technique is presented for the first time in the literature. (J Vasc Surg 2014;59:511-5.)

Infection of endovascular material is rare.[1] We report the case of a 60-year-old male patient who presented with a false aneurysm of the common iliac artery caudal to an aorta with laminated thrombus and methicillin-resistant *Staphylococcus aureus* septicemia in the immediate postoperative period of an endovascular intervention (kissing covered stents of the aortic bifurcation done in another center) for bilateral intermittent claudication (Fig 1; Video 1, online only). A nonbifurcated panel reconstruction using the greater saphenous vein (GSV) for the reconstruction of the femoral artery due to prosthetic graft infection has previously been described.[2] To our knowledge, this is the first reported case of any bifurcation reconstruction using GSV panels. We believe that this approach can be useful for selected cases.

TECHNIQUE

According to our technique, the length (L) of the GSV required can be estimated using the equation: $L = (A)(X/Y)$; where A is the length of the vessel or graft that needs to be replaced, X is the perimeter of the vessel or graft that needs to be replaced, and Y is the perimeter of the saphenous vein (Fig 2). The average perimeter of GSV is calculated from an estimation of the average diameter from the preoperative Doppler ultrasound at three locations with the patient supine. The minimal diameter considered suitable was 3 mm with a preference for the crural GSV, which is subsequently outlined with a marker. In this case, we estimated replacing both iliac arteries (A = length of right common iliac + length of left common iliac).

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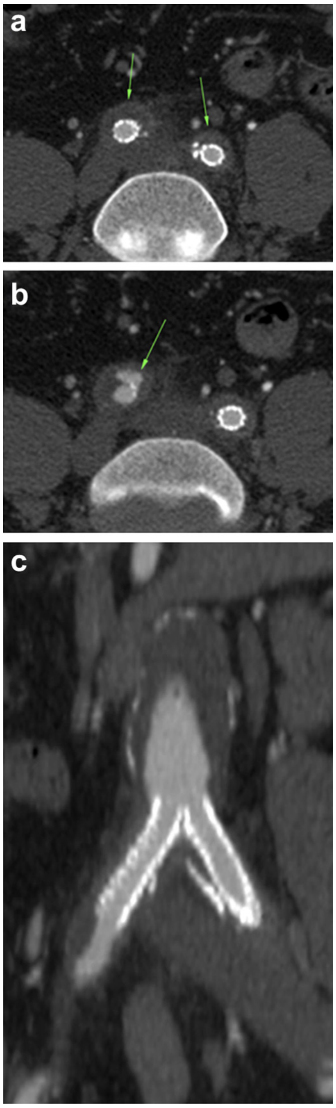

Fig 1. Preoperative computed tomography (CT) scan. **a** and **b,** Axial view, *green arrows* point to the perivascular infiltration while on **(b)** a false aneurysm is observed; **c,** coronal view.

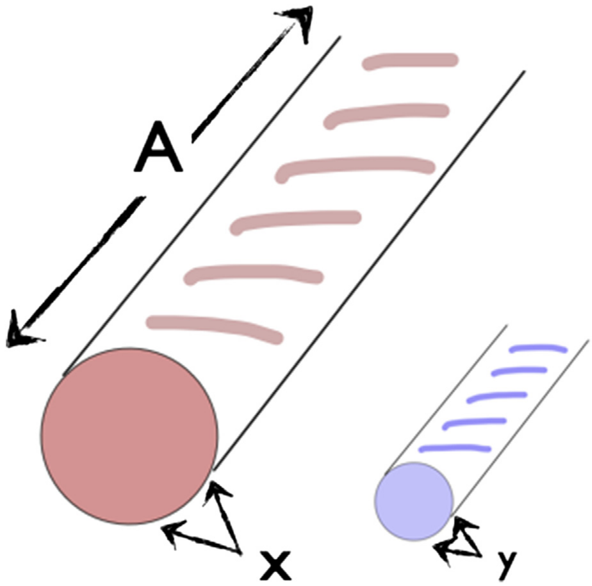

Fig 2. Illustration of the parameters A, X, and Y that define the necessary length of venous graft. The length (L) of the GSV required can be estimated using the equation: L = (A)(X/Y).; where *A* is the length of the vessel or graft that needs to be replaced, *X* is the perimeter of the vessel or graft that needs to be replaced, and *Y* is the perimeter of the saphenous vein.

The GSV of the right thigh was harvested via interrupted skin incisions. It was then longitudinally opened but not vertically transected. The aortic bifurcation was dissected without particular difficulties via midline laparotomy approach. The two covered stents were found floating within necrotic tissue and pus (Fig 3). A thorough lavage was performed with saline and antiseptic solution. The reconstruction was performed with: (1) two patches replacing the posterior wall of the common iliac arteries (tailored on the aorta proximally and iliac bifurcation distally at each side); (2) one unique folded patch that replaced the antero-internal wall of both common iliac arteries (tailored longitudinally at each side with the two posterior patches and distally on the iliac bifurcation at each side); and (3) two patches that formed the antero-exterior wall of both common iliac arteries (tailored longitudinally on the posterior and internal patches, proximally on the aorta, and distally on the iliac bifurcation at each side). It is important to mention that each patch was cut off from the saphenous graft after the suturing had started in order to avoid any loss of useful graft length (Figs 3-5). The procedure lasted 5 hours, with approximately 3 hours of aortic cross-clamping.

Recovery was uneventful, and tissue cultures were positive for methicillin-resistant *Staphylcocus aureus*, the same organism found on preoperative hemocultures. The patient was continued on intravenous gentamicin and vancomycin as per sensitivities for a total duration of 6 weeks.

The patient was discharged on day 7 following clinical improvement and a computed tomography angiography (CTA) imaging showing resolution of the perivascular

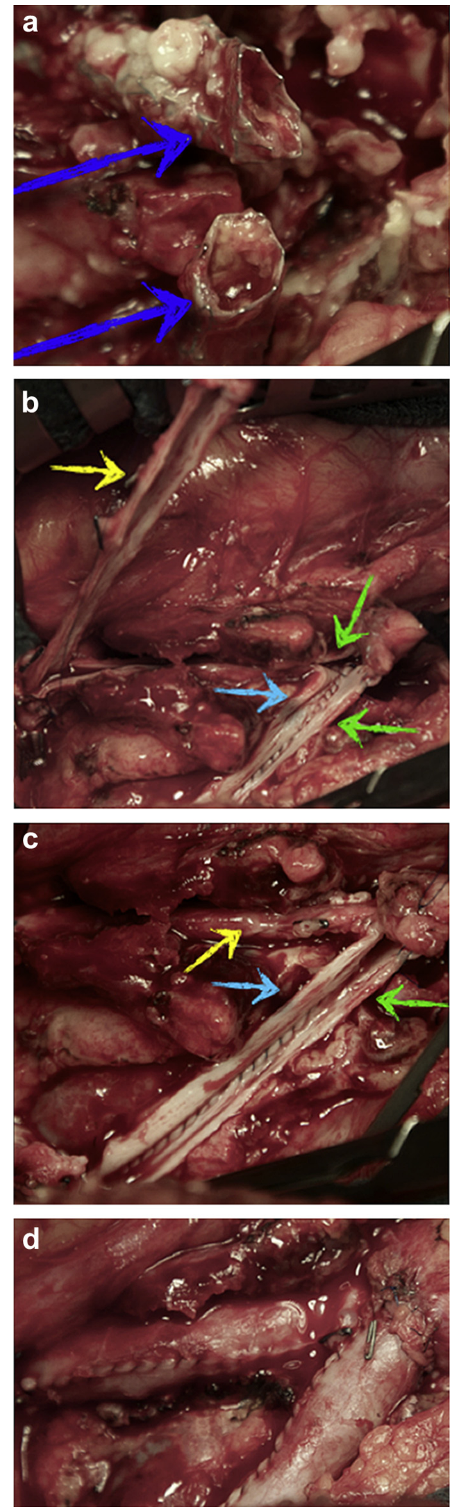

Fig 3. Intraoperative photos. **a,** Explantation of the iliac stents (*blue arrows*); **b,** after suturing the two posterior (*green arrows*) and the unique antero-interior patch (*light blue arrow*), starting the suturing for the right antero-exterior patch (*yellow arrow*); **c,** before suturing the left antero-exterior patch; and **d,** final image after declamping.

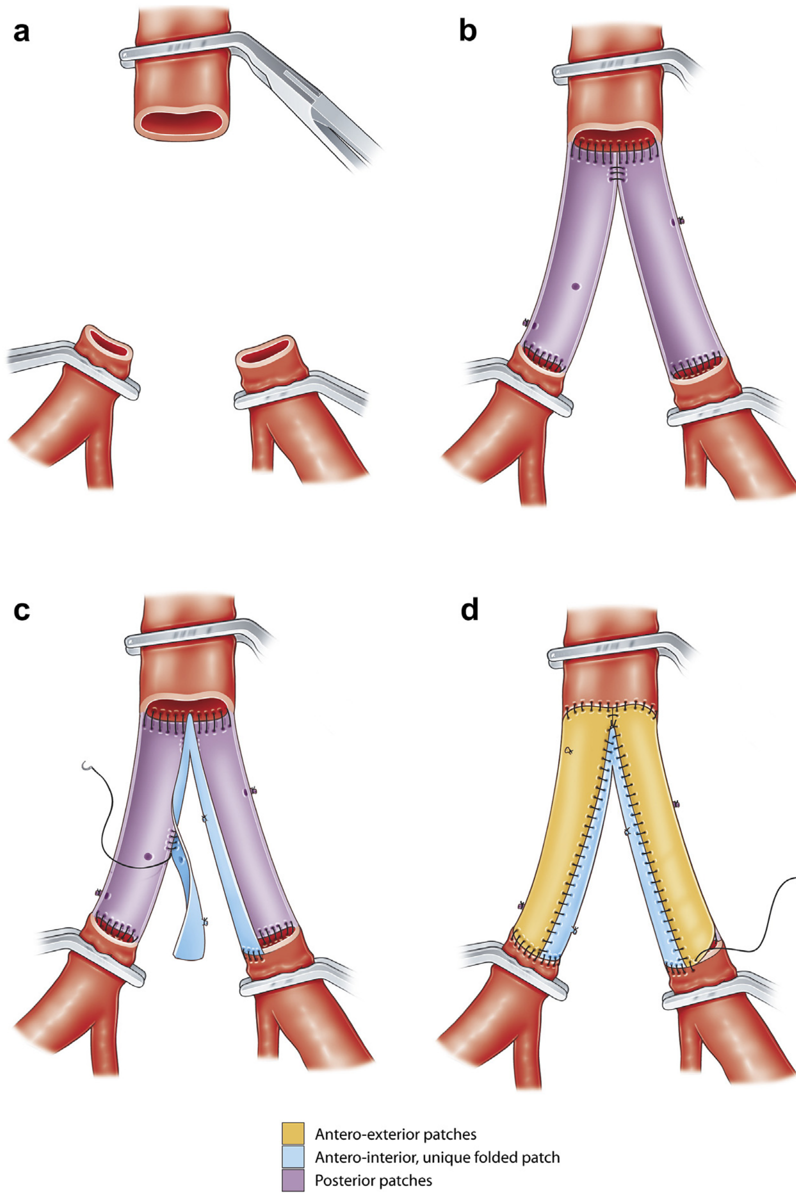

Fig 4. Illustration of the reconstruction. **a,** Before suturing; **b,** after suturing the posterior patches; **c,** after suturing the unique antero-interior patch; and **d,** final view after suturing the antero-exterior patches.

inflammation and satisfactory bifurcation reconstruction. (Fig 6; Videos 2 and 3, online only). On 6-month follow-up, CTA scan was satisfactory, and the patient was well but complained of retrograde ejaculation (Video 4, online only).

DISCUSSION

Preoperative imaging revealed ectasia of the aorta with irregular laminated thrombus proximal to the iliac stents and the presence of a false aneurysm and inflammatory infiltration at the level of iliac arteries. The aorta was clamped at the most proximal possible level below an inferior left renal polar artery (Video 1, online only). This was in order to apply the clamp on a smaller diameter vessel with less mural thrombus. This effort, along with heparin administration and regular activated clotting time control, was crucial for avoiding thromboembolic complications that may arise after an extended period of aortic cross-clamping.

At 6 months, the CTA revealed stability of the aortic diameter and no evidence of dilatation of the GSV panels (Video 4, online only). Should the aortic diameter increase sufficiently to warrant surgical intervention, we would prefer endovascular aortic repair to avoid potentially challenging dissection.

Nonbifurcated panel reconstruction using the greater saphenous vein (GSV) for the reconstruction of both iliac

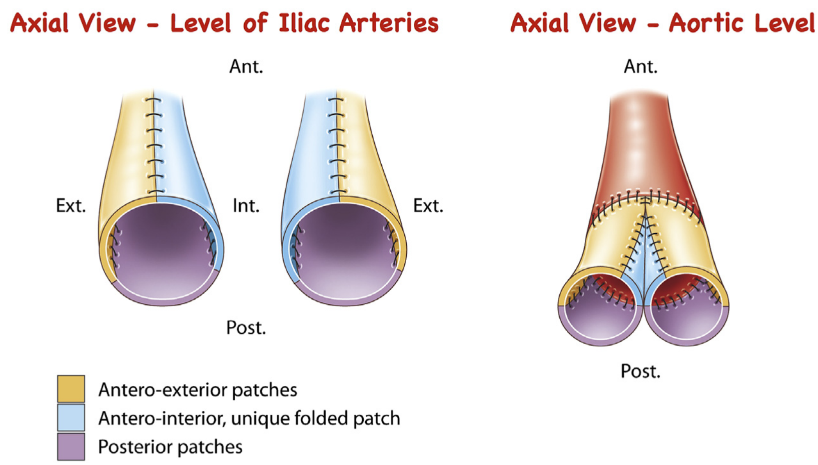

Fig 5. Illustration of the reconstruction, axial view at the iliac (*left*) and aortic (*right*) level. *Ant,* Anterior; *Ext,* exterior; *Int,* interior; *Post,* posterior.

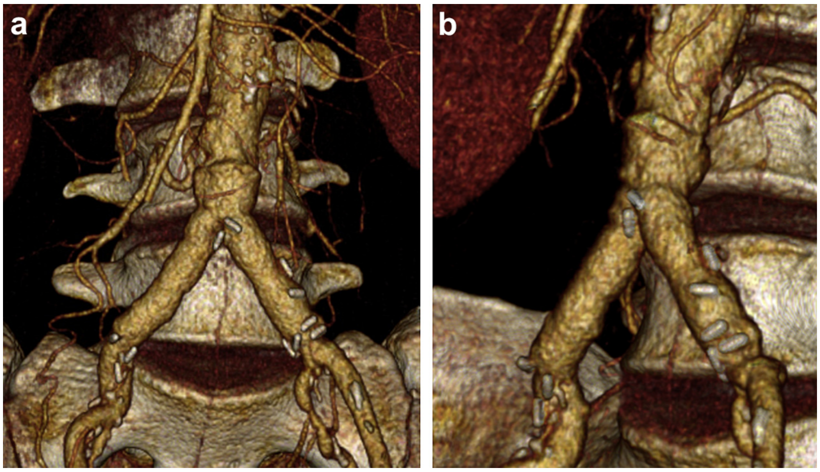

Fig 6. Postoperative computed tomography (CT) scan (3D reconstruction). **a,** anterior view; **b,** left oblique view.

and femoral arteries in contaminated fields and to replace an infected prosthetic graft have previously been described.[2,3] DuBay et al have used a superficial femoral vein cylindrical panel graft for caval reconstructions in the context of extensive tumor resection.[4] Various alternative options were discussed for this patient.

We considered that, given his age, an extra-anatomic bypass was not the optimum solution. Van Zitteren et al reported some excellent results with the use of spiral vein grafts.[5] During a 13-month mean follow-up (range, 6-67 months), there was no reinfection, while patency and survival was 100%. Although for cylindrical vessel replacement this technique is feasible, we believe that it is not applicable for the reconstruction of a vessel bifurcation. Nonetheless, we believe that in terms of patency and durability results should be expected to be similar.

Creating a neo-aortoiliac system (NAIS) with the femoral-popliteal vein (FPV) might also be an option.[6-8] Ali et al reported primary assisted patency/secondary patency of 81% and 91%, respectively, in 187 patients who underwent NAIS using FPV.[8] These results are particularly encouraging considering 144 patients (77.3%) underwent aorto bifemoral reconstructions. Panel reconstruction of the GSV maintains the advantages of autogenous FPV grafts, including the large caliber, infection resistance, and nonthrombogenic surface, and, one would presume, similar patency rates. Furthermore, GSV reconstruction does not involve significant chronic venous morbidity, conservatively reported to be 15% for FPV harvesting.[8]

Results with cryopreserved human allografts seem to be encouraging,[9] but the method remains costly, not widely available, and nonautologous.

Poor quality or insufficient length of the GSV are potential drawbacks that need to be ascertained preoperatively. NAIS using the GSV requires a long suture line to be performed in situ, requiring prolonged cross-clamping time.

In some patients with severe comorbidities, this may not be well tolerated.

CONCLUSIONS

Autologous reconstruction of the aortic bifurcation is technically challenging. This is the first report of successful, anatomic, in situ reconstruction with great saphenous vein panel graft. It is a new technique that can be useful in selected cases.

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