Use of superficial femoral vein for hemodialysis arteriovenous access

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Maintaining hemodialysis access in the expanding number of patients with end-stage renal disease is a difficult and challenging problem. Published guidelines outline the initial recommendations for hemodialysis access; however, there is little consensus about the most appropriate options for the subset of patients with repeated access failures and/or unsuitable veins. Two case reports are presented describing the use of composite saphenous–superficial femoral vein autogenous accesses placed in the upper and lower extremities. The function of the autogenous accesses appeared to be similar to a mature arteriovenous fistula in the short-term, although further longitudinal studies are required. The superficial femoral vein may be a useful hemodialysis access conduit for patients with limited access options. (J Vasc Surg 2000;31:1038-41.)

Maintaining access for hemodialysis is a difficult and challenging problem. The overall failure rate for all permanent accesses has been estimated at 0.8 episodes per patient per year at risk.[1] The associated social and economic burden is staggering: access-related complications are the leading cause of acute hospitalizations for patients with end-stage renal disease,[2] and the annual cost of maintaining access has been estimated at $1 billion.[3] Furthermore, the magnitude of the problem will only likely increase in light of the aging population, the increased number of patients with end-stage renal disease, and their increased longevity. The NKF-DOQI Clinical Practice Guidelines[4] outline an algorithm for the initial evaluation of patients with end-stage renal disease. However, there is little consensus about the most appropriate access options in the growing subset of patients with repeated access failures, unsuitable veins for arteriovenous fistula, and/or relative contraindications to prosthetic material. This brief communication presents two patients who underwent construction of a composite autogenous arteriovenous access using the superficial femoral vein.

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CASE REPORT

Case 1. The patient was a 29-year-old African American woman with a 9-year history of end-stage renal disease of unknown etiology who was referred to the authors for permanent hemodialysis access. At the time of initial presentation, she was dialyzing through a right internal jugular Tesio catheter. She had a history of a failed cadaveric renal transplant and was not a candidate for a second transplant because of elevated antibody titers. She had previously undergone peritoneal dialysis, although it was discontinued because of inadequate exchanges resulting from multiple intra-abdominal adhesions. She had a history of four failed prosthetic arteriovenous accesses (left upper extremity [two], right upper extremity, right thigh); all of the accesses had failed in the first 2 months despite oral anticoagulation.

Preoperative evaluation included invasive and noninvasive imaging of the extremities. The noninvasive upper extremity arterial study showed symmetric pressures and biphasic waveforms at the wrist. Noninvasive venous imaging showed diminutive (<2 mm) cephalic and basilic veins bilaterally, an occluded left internal jugular vein, no evidence of deep venous thrombosis in the lower extremities, and marginal (2.5–3.0 mm) saphenous veins from the thigh to the knee bilaterally. A venogram of the bilateral upper extremity showed occluded left internal jugular, left brachiocephalic, and right internal jugular veins, but patent right axillary, subclavian, and brachiocephalic veins. The results from an arteriogram of the arch and right upper extremity were normal.

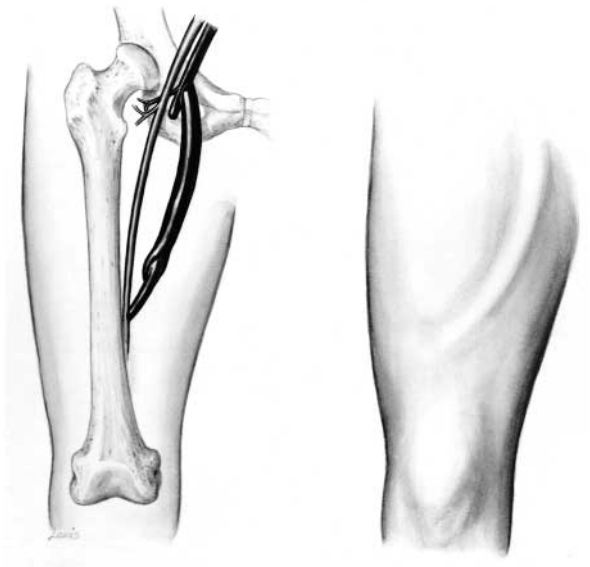

Fig 1. The configuration of the thigh autogenous access and its superficial appearance. A composite saphenous–superficial femoral vein composite graft was constructed. Both vein segments were used in a reversed fashion, and the valves were not lysed. The arterial anastomosis was performed to the distal superficial femoral artery near the level of the adductor canal, and the venous anastomosis was performed to the common femoral vein.

The patient underwent a right axillary artery–axillary vein arteriovenous loop access with 8 mm of polytetrafluoroethylene. The graft was thrombosed on the first postoperative day. The polytetrafluoroethylene graft was removed and replaced with a composite autogenous access composed of right saphenous and superficial femoral veins in the same axillary artery–axillary vein configuration with both vein segments reversed. The autogenous access was thrombosed on the first postoperative day. No technical defects were identified to explain the failure of the prosthetic or autogenous access. The autogenous access was removed from the chest wall and used to create a right superficial femoral artery–common femoral vein access using the same orientation (Fig 1).

The patient's postoperative course was complicated by a breakdown of her thigh wound necessitating readmission for wound care. The autogenous access was cannulated for hemodialysis at approximately 6 weeks postoperatively. She has continued her anticoagulation with a presumed diagnosis of a hypercoagulable state. The patient has dialyzed through the access for the past 16 months without problems.

Case 2. The patient was a 61-year-old white man with a history of chronic renal insufficiency resulting from Wegener's granulomatosis who was referred to the authors

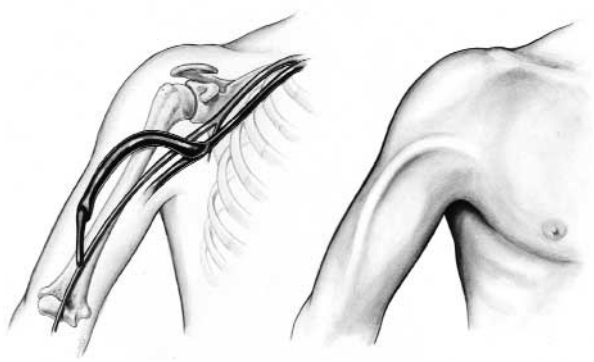

Fig 2. The configuration of the arm autogenous access and its superficial appearance. A composite saphenous–superficial femoral vein composite graft was constructed. Both vein segments were used in a reversed fashion, and the valves were not lysed. The arterial anastomosis was performed to the brachial artery proximal to the antecubital crease, and the venous anastomosis was performed to the axillary vein within the axilla.

for permanent hemodialysis access. His serum creatinine level was 6.8 mg / dL, and it was anticipated that he would need to dialyze soon. He had a Tenckhoff catheter inserted 3 years before presentation, but it had never been used. He was given both cyclophosphamide (Cytoxan) and prednisone for his Wegener's granulomatosis.

Preoperative evaluation included invasive and noninvasive imaging. The noninvasive upper extremity arterial study showed symmetric pressures and monophasic waveforms at the wrist. Noninvasive venous imaging showed diminutive cephalic and basilic veins bilaterally, no evidence of central vein thrombosis in the upper extremities, no evidence of deep vein thrombosis in the lower extremities, and marginal saphenous veins bilaterally. The results of a venogram of the right upper extremity were consistent with the noninvasvie studies. An arteriogram of the arch and right upper extremity showed a diffusely diseased radial artery.

The patient underwent a right brachial artery–axillary vein autogenous access using composite saphenous and superficial femoral veins (Fig 2). Both the superficial femoral and saphenous vein segments were reversed. The basilic vein was exposed before performing the autogenous access, but was unsuitable for an arteriovenous fistula.

The patient's immediate postoperative course was complicated by a small breakdown of his vein harvest incision. The access was cannulated for hemodialysis approximately 2 months postoperatively. Shortly after dialysis was initiated, the patient had a hematoma adjacent to the proximal segment of the graft that was due to the misplacement of the dialysis cannula. Approximately 8 months postoperatively, the flow detected through the access was noted to decrease. A shuntogram showed a stenosis in the graft near the superficial femoral vein–axillary vein anastomosis. This

was subsequently revised with an interposition graft from the distal aspect of the superficial femoral vein to the more distal axillary vein using an additional segment of superficial femoral vein. The flows detected through the graft returned to their baseline level, and no further problems have developed over the subsequent 5 months.

DISCUSSION

The superficial femoral vein may represent a useful conduit for hemodialysis access. The diameter ranges from 6 to 10 mm in adults, and the wall is thick, relative to the basilic and cephalic veins. The latter makes it easy to handle and may attenuate the requisite time (1–4 months) necessary for native arteriovenous fistula maturation. Although the case reports represent the first known use of the superficial femoral vein for hemodialysis access, the conduit has been used extensively as a conduit for aortic reconstructions,[5] venous reconstructions,[6] and infrainguinal revascularizations[7] with good long-term results. The early results suggest that the autogenous access functions like a mature arteriovenous fistula. However, it remains to be seen whether it will endure the repeated cannulations or will develop intimal hyperplasia at the venous anastomosis (common femoral vein, axillary vein), such as prosthetic accesses. Unfortunately, there are several negative aspects to using the superficial femoral vein as an access conduit that temper our enthusiasm for using it as a primary conduit when other options are available. Harvesting the vein is significantly more time and labor intensive than using prosthetic accesses and routinely requires 30 to 45 minutes to harvest 30 cm of vein. There is the potential for significant venous morbidity. However, Wells et al[8] have reported fairly minimal long-term venous morbidity using fairly sophisticated venous imaging. The superficial femoral vein is located deep in the thigh, and its harvest is associated with significant soft tissue injury. This may well increase the wound complication rate in patients with compromised wound healing. Finally, using the superficial femoral vein as an autogenous access precludes its use in other settings.

There are several technical points that merit further comment. The superficial femoral vein was harvested through an incision that ran diagonally over the anteromedial aspect of the thigh extending from approximately 8 cm below the inguinal crease to above the knee. This incision allowed us to harvest both the superficial femoral and saphenous veins with minimal skin flaps. The sartorius muscle was retracted laterally in the proximal thigh and medially in the distal thigh to expose the vein. It was necessary to take down the adductor canal to expose the vein completely. We constructed a composite saphenous and superficial femoral vein access for two reasons. First, the composite configuration increased the overall length of the access. This allowed us to maximize the amount of deep vein tunneled through the subcutaneous plane. This was particularly important for the patient with the thigh fistula where the distance from the superficial femoral artery to the subcutaneous tissue was several centimeters. Second, the smaller diameter of the saphenous vein potentially limited the quantity of blood flow through the graft and thereby avoided ischemic complications. The venous anastomosis in the patient with the arm access was performed to the axillary vein deep in the axilla at a point where the size was comparable to the superficial femoral vein. The venous anastomosis in the patient with the thigh access was performed to the common femoral vein. The thigh access served as a salvage procedure after the chest wall access had failed. It would have been possible to simply transpose the superficial femoral vein to a subcutaneous plan and configure the autogenous access from the superficial femoral artery–saphenous vein–superficial femoral vein and avoid a venous anastomosis in the groin altogether and limit the procedure to two anastomoses. Indeed, we have used this configuration in a subsequent patient.

The role of the superficial femoral vein autogenous access remains undefined because of the lack of long-term follow-up and the negative aspects highlighted above. We have reserved the procedure for patients with limited hemodialysis access options and contraindications to prosthesis as emphasized by the case presentations. The patient who received the thigh access had exhausted all upper extremity access configurations, had repeatedly thrombosed all prosthetic grafts despite anticoagulation, and was not a peritoneal dialysis or transplant candidate. The patient with the arm access had no suitable options for an upper extremity arteriovenous fistula and a relative contraindication to a prosthetic graft due to his immunocompromised state from the prednisone and cyclophosphamide (Cytoxan). Admittedly, the patient could have had a brachial artery–axillary vein prosthetic access. However, we have adopted a policy to use autogenous configurations according to our institutional experience and the NKF-DOQI Guidelines[4] in an attempt to increase long-term patency and decrease the infectious complications.

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