

Femoral vein transposition for arteriovenous hemodialysis access: Improved patient selection and intraoperative measures reduce postoperative ischemia

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Purpose: Construction of prosthetic arteriovenous access for hemodialysis in the thigh results in a high incidence of graft failure and infection. Autogenous femoral artery–common femoral thigh transposition (transposed femoral vein [tFV]) arteriovenous accesses have superior patency, but our previous report documented a high incidence of ischemic events requiring secondary surgical intervention. Recent results of improved patient selection and intraoperative maneuvers to reduce ischemia are unknown.

Methods: During a 6-year period eight children (mean age, 13.3 years) and 46 adults (mean age, 52.3 years; 27 female, 19 male) underwent construction of 55 tFV thigh accesses for hemodialysis access. Adult patients were divided into groups I and II on the basis of the introduction of specific strategies to reduce the incidence of ischemic complications. In the cohort of children, steal prophylaxis included one banded femoral vein, three tapered femoral veins, two distal femoral artery pressure measurements taken before and after access construction (mean ratio, 0.70), and two closed anterior and superficial posterior compartment fasciotomies. Of the first 25 accesses in adults (group I, mean age, 55.9 years), 10 had access banding (six at the initial procedure and four in the immediate postoperative period to treat ischemia). Of the second 22 accesses (group II, mean age, 48.2 years), steal prophylaxis included 14 tapered femoral veins, 6 distal femoral artery pressure measurements (mean ratio, 0.76; range, 0.62 to 0.86), and 1 fasciotomy. Patients with significant distal occlusive disease were not offered a tFV access in the time frame of group II.

Results: Eight accesses in children had 100% primary functional patency at 2 years, with no reoperations for ischemia. Nine group I adult patients underwent remedial procedures to correct distal ischemia. No adult patient in group II required a remedial procedure to correct ischemia. Groups I and II 2-year secondary functional access patency was 87% and 94%, respectively. There were no access infections in either group. Femoral vein tapering significantly reduced the need for remedial correction of ischemia ($P = .03$).

Conclusions: Improved patient selection and selective intraoperative femoral vein tapering eliminated remedial procedures to correct ischemia in patients undergoing tFV access. Patency rates were excellent despite the liberal use of vein tapering. Transposed FV access should be considered for good risk individuals undergoing their first lower extremity access. (*J Vasc Surg* 2005;41:279-84.)

Our recent report of 25 autogenous superficial femoral–common femoral thigh transposition (transposed femoral vein [tFV]) arteriovenous accesses for hemodialysis indicated a 2-year secondary patency rate of 87%, minimal morbidity from edema, and no access infections.¹ Nine of our first 26 patients, however, developed an ischemic complication requiring remedial surgical intervention. In an attempt to reduce the incidence of postoperative ischemic complications in subsequent patients, we excluded patients with distal occlusive disease and initiated prophylactic intraoperative measures to avoid ischemia, yet maintain good patency rates. This report compares outcomes of both patient cohorts to determine the efficacy of these measures.

PATIENTS AND METHODS

Between March 1998 and December 2003, 54 patients underwent elective construction of 55 tFV accesses for hemodialysis. One patient had bilateral procedures. Follow-up was completed through July 2004. All candidates for the procedure were deemed to have exhausted or have a specific contraindication to an upper extremity access. Preoperative studies in selected patients included ankle-brachial indices and femoral vein duplex ultrasound scanning. The basic technique of tFV access construction is described in our initial publication.¹ Briefly, the femoral vein, in continuity with a variable length of supragenicular popliteal vein, is mobilized from the popliteal fossa to the junction of the femoral vein with the profunda femoris vein. The vein is transposed superficially, analogous to an autogenous brachial-basilic upper arm transposition (basilic vein transposition), and implanted on the distal femoral artery between the divided adductor tendon and the inferior border of the sartorius muscle.

Patients were divided into two groups on the basis of the introduction of specific strategies to reduce the incidence of ischemic complications. In group I ($n = 26$,

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Competition of interest: none.

Presented at the 19th Annual Meeting of the Western Vascular Society, Victoria, British Columbia, Canada, Sep 11-14, 2004.

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0741-5214/\$30.00

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doi:10.1016/j.jvs.2004.10.039

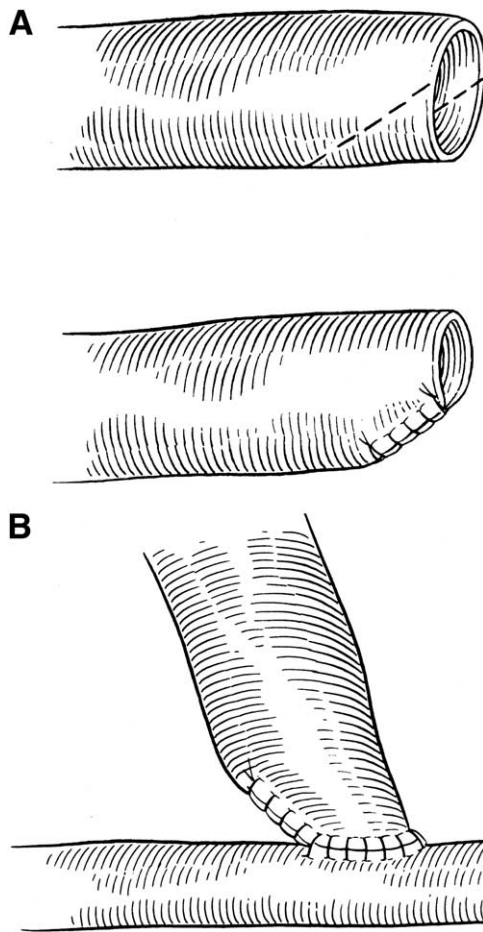


Fig 1. In selected cases, the femoral vein is tapered to a 4.5- to 5.0-mm diameter (A) before implantation on the distal femoral artery (B).

March 1998 to July 2000) the measures used to avoid postoperative ischemia in selected individuals were access banding and, in individuals with arterial occlusive disease, either origination of the access from the distal end of a prosthetic femoropopliteal bypass graft or construction of a composite prosthetic-femoral vein femoral inguinal looped access. Group I includes the 25 originally published patients along with the twenty-sixth patient in the series. In group II ($n = 29$, August 2000 to July 2004) we excluded individuals with significant arterial occlusive disease (a requirement for a sequential or composite access, absent pedal pulses, or an ankle-brachial index of <0.85) and individuals who were both old and frail. Intraoperative measures used to avoid postoperative ischemia in selected group II individuals included tapering of the femoral vein at the takeoff from the distal femoral artery (Fig 1), closed anterior and superficial posterior compartment fasciotomies when pulses were very weak or absent immediately after access construction, and measurement of proximal popliteal artery pressure after access construction. The ratio of this pressure to that obtained with the access temporarily

occluded provides an index of access-induced pressure reduction. A value of 0.6 was accepted as not likely to induce clinical ischemia. For each tFV candidate, the decision whether to use one or more intraoperative measures to avoid postoperative ischemia was left to the surgeon's discretion.

We generally followed the recommended Vascular Society reporting standards for arteriovenous hemodialysis access surgery.² An access requiring polytetrafluoroethylene (PTFE) to maintain patency or relieve ischemia was considered secondarily patent if both hemodialysis access needles could be placed in the femoral vein. Access abandonment was recorded as failure of secondary patency. The main outcomes studied were primary and secondary functional access patency, as well as freedom from remedial surgery to treat a postoperative ischemic complication (pedal ischemia, a compartment syndrome, or ischemic monomelic neuropathy). Patients with ipsilateral below knee amputations were excluded from analysis of reoperation for ischemia.

The outcomes in children (age, <21 years; $n = 8$) were analyzed separately to provide meaningful results for the more commonly encountered adult hemodialysis population. Thus, group I was left with 25 adult accesses and group II with 22 adult accesses.

Patient characteristics and comorbidities, as well as other comparisons between groups, were analyzed with the Fisher exact test or Student t distribution. Kaplan-Meier curves were constructed for primary and secondary functional patency, as well as for freedom from reoperation for ischemia. The log-rank statistic was used to compare group I and II survival curves for primary and secondary patency, and freedom from reoperation for ischemia, and to compare tapered and nontapered accesses for effectiveness in avoiding reoperation for ischemia. A Cox proportional hazards regression was used to identify factors possibly contributing to access failure and reoperation for ischemia.

The Cedars-Sinai Medical Center Institutional Review Board approved this study (4460-01).

RESULTS

Tables I and II outline patient characteristics and comorbidities for all patients.

Children. Of eight children, one had femoral vein banding, three had femoral vein tapering, two had closed anterior and superficial posterior compartment fasciotomies, and two had access induced pressure ratios of 0.68 and 0.75. The 2-year primary and secondary functional access patency was 100%, with no reoperations for ischemia. One child developed a lymphocutaneous fistula that was closed surgically 3 weeks after access construction.

Adults. Although group I adult patients had proportionally greater women, diabetics, older patients, and composite accesses than those in group II, none of these differences was significant.

No patient in the time period of the first 25 adult patients (group I) was excluded solely because of distal occlusive disease. Twenty of these patients had straight

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