From the Society for Clinical Vascular Surgery

Management of noninfected prosthetic aortic bypass failures using femoral vein

Sara C. McKeever, DO, Guillermo A. Escobar, MD, Mohammed M. Moursi, MD, Ahsan T. Ali, MD, and **Matthew R. Smeds, MD,** *Little Rock, Ark*

Objective: **The use of femoral-popliteal vein as a conduit to treat infected aortoiliac pathologies has been described extensively and is referred to as the neoaortoiliac system procedure. We examined our center's outcomes after using deep vein as a conduit for the salvage of failed aortofemoral prosthetic bypasses in patients without infection.**

Methods: **Procedures using femoral vein as conduit at the University of Arkansas for Medical Sciences between January 2005 and July 2013 were retrospectively reviewed (n = 110). Patients were excluded if the reconstruction was for infectious etiologies (n = 71) or for nonaortofemoral reconstructions (n = 31). Operative variables, complications, and patency rates were collected.**

Results: **Femoral vein was used to revascularize failed aortobifemoral bypasses in eight patients. Indications included rest pain (n = 7) and short-distance claudication (n = 1). Reconstructions identified two patients each with aortobifemoral bypass or aortofemoral bypass, and one patient each with aortofemoral bypass with femorofemoral bypass, aorotoiliac bypass, iliofemoral bypass with femorofemoral bypass, or ilioprofunda bypass. Mean follow up was 27.5 months. There were no major postoperative complications. Symptoms secondary to deep vein harvest (swelling/dermatitis) developed in three of eight patients. The average ankle-brachial index improved from 0.33 to 0.73 ($P = .003$), with a limb salvage rate of 100%. Kaplan-Meier analysis found primary patency was 70% at 1 year and 53% at 5 years, which improved to 100% and 75%, respectively, with secondary measures.**

Conclusions: **Despite a need for secondary interventions and venous hypertension syndromes, deep vein offers good patency and excellent limb salvage after failed prosthetic aortoiliac bypasses. (J Vasc Surg 2016;63:642-5.)**

Aortoiliac occlusive disease resulting in lifestyle-limiting claudication or critical limb ischemia that is not amenable to endovascular therapy is an indication for aortobifemoral bypass. This well-described open surgical technique has been shown to have excellent long-term patency rates approaching 85% at 5 years.[1] However, failure of these bypasses can result in poor long-term outcomes. Repeat aortic bypass with prosthetic conduit results in a nearly 25% failure rate, and a third reoperation for this type of bypass may lead to amputation in all cases.[2,3] Factors identified with failure of aortofemoral bypass include young age at initial bypass, continued smoking history, distal occlusive disease, and coronary artery disease.[4]

The neoaortoiliac system (NAIS), a technique that is often used for treating infected aortofemoral bypasses, uses the femoropopliteal veins as conduits for aortic reconstruction. It can be performed in a single operation or as a staged procedure, with harvest of deep vein on one day and reconstruction of the aortoiliac system on the subsequent day.[5] The procedure has perioperative morbidity rates of 10% to 20%, including amputation, lower extremity venous hypertension complications, and wound infections, and a mortality rate of 10% to 20% when used for infected aortic grafts; however, NAIS has demonstrated an excellent 5-year primary assisted patency of >90%.[4]

This technique has been used in noninfected situations, but its use as salvage for failed aortofemoral bypass grafts has not been previously described.[6] Our hypothesis was that the use of deep vein to treat noninfectious failures of aortofemoral bypass grafts is a viable option in patients who have had prosthetic graft failure procedures, offering an excellent limb salvage and patency that is better than repeated prosthetic bypass.

METHODS

A retrospective review was performed of all patients undergoing reconstructions using deep vein from January 2005 to July 2013. We included for analysis all patients with failed prosthetic aortobifemoral bypass. Procedures done using deep vein for replacement of infected grafts were excluded. All procedures were performed at a single hospital by one of four full-time surgeons. Patient medical records were reviewed for demographic information, intraoperative data, 30-day postoperative adverse events, and clinical follow-up, as well as freedom from amputation and use of any secondary procedures performed after the

From the Department of Vascular and Endovascular Surgery, University of Arkansas for Medical Sciences.

Author conflict of interest: none.

Presented at the Forty-second Annual Symposium of the Society for Clinical Vascular Surgery, Carlsbad, Calif, March 18-22, 2014.

Correspondence: Matthew R. Smeds, MD, Division of Vascular and Endovascular Surgery, University of Arkansas for Medical Sciences, 4301 W Markham St, #520-2, Little Rock, AR 72205 (e-mail: mrsmeds@uams.edu).

The editors and reviewers of this article have no relevant financial relationships to disclose per the JVS policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

0741-5214

http://dx.doi.org/10.1016/j.jvs.2015.09.014

initial intervention. The University of Arkansas for Medical Sciences Institutional Review Board approved our study protocol and waived patient consent due to the minimal risk and retrospective nature of this study.

Kaplan-Meier estimates were performed to determine overall survival and freedom from a major adverse limb event. A paired *t*-test with two-tailed *P* values was used for analyzing continuous data. A *P* value of $<.05$ was considered statistically significant.

RESULTS

During the study period, 110 patients underwent procedures using deep vein at our institution. Of these procedures, 71 were performed for replacement of infected vascular prosthesis. In the remaining 39 patients, deep vein was used for vascular reconstructions in noninfected fields and was used in eight of these patients to salvage a failed aortobifemoral prosthetic bypass. The demographics in this group of patients are similar to other patients with aortoiliac occlusive disease. The average age was 52 years, 66% were men, and all had a smoking history. Interestingly, none of the patients had a history of diabetes or renal disease (Table I).

Table I. Patient demographics

Variable	*No. (N = 8)*
Male	5
Smoking history	8
Current smoker	6
Former smoker	2
Diabetes	0
Hypertension	4
Coronary artery disease	5
End-stage renal disease	0
Hypercholesterolemia	5

An average of 2.9 aortoiliac interventions (range, 1-4) were performed before reconstruction using deep vein, and the indications for NAIS were rest pain in seven patients and claudication in one (Table II). The average time to procedure from the original prosthetic aortofemoral bypass was 25 months. In these eight patients, 12 limbs were revascularized. Two patients underwent aortobifemoral bypass grafts, two underwent aortofemoral bypass, and one underwent aortofemoral bypass with concurrent femoral-femoral bypass. One patient underwent aortoiliac bypass, one had iliofemoral bypass with concurrent femoral-femoral bypass, and the last had an ilioprofunda bypass.

Deep vein was harvested from both legs in three patients and from one leg in five patients. No harvests were staged. Secondary procedures done on same day as bypass included bilateral fasciotomies in one patient who underwent NAIS for acute aortic occlusion, a planned above-knee amputation in one patient for nonsalvageable leg, and an extended profundaplasty, superficial femoral artery endarterectomy, and bypass to the superficial femoral artery to improve outflow in one patient. Of note, procedures to improve outflow were only done in one patient, the remainder had outflow via at least a large profunda, and most had runoff via the profunda and superficial femoral artery. The procedures were an average length of 554 minutes (range, 310-840 minutes), and estimate blood loss was not insignificant, at an average of 1269 mL (range, 200-3300 mL).

Perioperative morbidity occurred in four of eight patients. Three patients had venous morbidity with swelling and stasis dermatitis (n = 2) or wound dehiscence (n = 1). The ankle-brachial index improved from 0.33 to 0.73 postoperatively ($P = .003$). Mean follow-up was 27.5 months (range, 2-60 months). Occlusion of a bypass limb occurred in two of eight patients during follow-up, one of which was in the immediate postoperative period and was salvaged with balloon angioplasty and stenting. The other occurred at 32 months and did not undergo intervention because of minimal symptoms. One patient underwent balloon angioplasty for significant stenosis, one underwent revision of a femoral-femoral bypass, and one underwent subsequent distal bypass for infrainguinal disease.

The primary patency by Kaplan-Meier estimate was 70% at 1 year and 53% at 5 years, which improved to 100% and 75%, respectively, with secondary measures (Fig). Of note, there were no major amputations on the revascularized limbs of interest during follow-up.

Use of anticoagulation was at the discretion of the attending surgeon. Two of eight patients were discharged on Lovenox (Sanofi, Bridgewater, NJ)/Coumadin (Bristol-Myers Squibb, Princeton, NJ). The remainder received antiplatelet therapy with aspirin or Plavix (Sanofi).

DISCUSSION

Aortobifemoral bypass with prosthetic material is considered the gold standard operation for aortoiliac occlusive disease, with a 10-year primary patency rate of 67% to 80% and excellent limb salvage.[1,2] Thus, failure of prosthetic aortobifemoral bypass grafts is an uncommon but potentially devastating problem. Graft stenosis or thrombosis can lead to lifestyle-limiting claudication, rest pain, and tissue or limb loss.

Options for redo operations include graft limb thrombectomy, reconstruction of isolated occluded limbs with a new bypass, or redoing the entire aortobifemoral bypass with a new prosthesis. These options have historically been wrought with challenges and are often insufficient for restoring adequate lower extremity flow.[3] Redo aortobifemoral bypass using prosthetic material can be accomplished and provides in-line inflow; however, it comes with high procedural complexity and greater need for adjunctive procedures, such as infrainguinal bypass or profundaplasty, and often-times different surgical approaches to the aorta such as a retroperitoneal incision. Patients undergoing redo aortobifemoral bypass also experience higher volume of blood loss and have longer overall procedure times.[4] The 2-year amputation-free survival is estimated to be