ELSEVIER

Long-Term Outcome of Endovascular Popliteal Artery Aneurysm Repair

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Background: Popliteal artery aneurysms have traditionally been repaired with an open surgical approach. However, endovascular popliteal artery repair (EVPAR) has been used in selected patients because of its less invasive nature. In this report, we present our long-term outcomes for EVPAR.

Methods: Retrospective review of all patients who underwent EVPAR at a single academic institution between September 2002 and March 2006. These patients were evaluated for patency, need for secondary intervention, amputation-free survival, and overall survival.

Results: A total of 15 limbs in 13 patients were treated with EVPAR during the study period. All EVPAR were performed using the Viabahn® endoprostheses, with an average of 1.67 stents per limb. The mean age of the patients was 74.6 years (range, 66-84). Technical success was achieved in 100% and all limbs had initial postoperative ankle-arm indices of $\geq$1.0. Mean duration of follow-up was 54 months (range, 42-70). Two patients died of unrelated causes at 3 and 38 months with intact limbs, and one patient was lost to follow-up. Two limbs developed type I or III endoleaks, and were successfully treated with additional endovascular stent placement, resulting in a primary patency rate of 84.6% and secondary patency rate of 100%. There were no instances of limb loss during the follow-up period, yielding both amputation-free survival and overall survival rates of 85.7%.

Conclusions: Long-term follow-up of this cohort of EVPAR patients suggests that in selected patients, this is a durable technique, capable of achieving excellent patency rates and limb preservation. Further large-scale clinical trials are warranted to help define optimal candidates for this technique.

INTRODUCTION

Popliteal artery aneurysms (PAAs), although uncommon, represent the most frequently encountered aneurysm within the peripheral vasculature.[1] PAA confers significant risk of limb loss because of the high rate of thromboembolic complications, and thus surgical exclusion has been recommended for aneurysms >2 cm in diameter, or those containing mural thrombus.[2,3] Since its introduction as treatment for PAA by Marin et al. in 1994,[4] endovascular popliteal artery repair (EVPAR) has gradually gained wider acceptance and use, especially after the development of expanded polytetrafluoroethylene-lined nitinol stents, such as the Viabahn® endoprosthesis (W. L. Gore & Assoc, Inc, Flagstaff, AZ). Several published studies, including our experience, have shown short- and medium-term outcomes comparing EVPAR with open repair surgery.[5-8] However, data regarding long-term outcomes of EVPAR remain sparse. This article presents the long-term outcomes for EVPAR in our initial cohort of patients.

METHODS

A retrospective review was performed of all patients who underwent EVPAR at a single academic

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institution between September 2002 and March 2006, and patients were evaluated for patency rate, need for secondary intervention, amputation-free survival, and overall survival. The study design and protocol was approved by the Washington University Institutional Review Board. Indications, complications, endoleak classification, and patency rates were reported in accordance with recommended standards.[9,10] *Patency* was defined as continued presence of palpable pedal pulses or maintenance of the initial postoperative ankle-arm index, with subsequent change of <0.15. Postoperative duplex ultrasound of the popliteal artery was not routinely used in all patients and thus was not included as an indicator of patency. *Symptomatic* patients were defined as those with claudication, rest pain, embolic stigmata, or venous hypertension attributed to the PAA. *Outflow* was defined as the number of patent tibial vessels from origin to ankle. Computed tomography angiography was the favored preoperative imaging modality. All EVPARs were performed in the operating room with portable C-arm fluoroscopy, and Viabahn® endoprostheses were used to exclude the aneurysm sac.

At the outset of our experience, there were no established rigid guidelines for EVPAR technique. However, we sought for proximal and distal landing zones of nonaneurysmal artery ≥2 cm length and avoided extending the distal terminus of the endograft(s) beyond the popliteal artery. The arterial diameter measurements were obtained from preoperative computed tomography angiography and the endografts were oversized 10-15% relative to the landing zones. When sequential endografts were required for complete aneurysm exclusion, an overlap of 2-3 cm between endografts was generally used. Overlapping endografts differed by no more than 2 mm in diameter so as to avoid longitudinal pleating of the larger graft which would result in loss of seal. When more than one endograft is used, the distal most endograft is deployed first and additional endografts are added proximally. This approach is preferred because the proximal landing zone tends to have a larger diameter and often require larger devices. The only way to ensure adequate seal between the endografts was to deploy the larger device within the smaller device. Arterial access was gained by percutaneous femoral access or mini-incision femoral artery exposure. Intraoperative imaging with a 0.018-inch guidewire-compatible intravascular ultrasound probe (Volcano, Rancho Cordova, CA) was frequently used to complement intraoperative angiography. Postoperatively, antiplatement medications were prescribed for all patients. When possible, clopidogrel was administered as the sole agent and this occurred in 13 of 15 (87%) limbs. The remaining two limbs were treated with aspirin therapy alone.

Primary patency, secondary patency, and survival estimates were generated by Kaplan−Meier analysis.

RESULTS

A total of 13 patients underwent elective EVPAR in 15 limbs. Patient demographics, surgical risk factors, and detailed procedural data are summarized in our previous publication.[8] Briefly, the cohort consisted of primarily male patients (14 limbs, 93%), with a mean age of 74.6 years (range, 66-84), and 13% were symptomatic at the time of repair. The median aneurysm diameter was 2.5 cm, and bilateral PAAs were present in 10 limbs (67%). All limbs had baseline ankle-arm indices s of ≥1.0, and tibial runoff status was evenly distributed between single-, two-, and three-vessel runoff, with 33% of patients in each group.

Balloon angioplasty of superficial femoral artery stenoses was required in two cases (13%) before endograft delivery. In both cases, the angioplastied segment was covered by the deployed endograft. Besides outflow thrombectomy and thrombolysis, adjunctive tibial artery stent was also performed in one case (7%).

Technical success was achieved in 100%. The majority of limbs (13, 87%) were treated with post-procedure clopidogrel. Major adverse event occurred in one patient (7%), who had a percutaneous antegrade ipsilateral femoral approach without the use of a closure device and subsequently developed a groin hematoma that required exploration and suture repair. All patients were otherwise discharged home without significant postoperative events.

During follow-up, two patients died of nonaneurysm-related disease with intact limbs. One patient died at 3 months because of respiratory failure after surgical repair of a hip fracture, and a second died of natural causes at 38 months. One patient was lost to follow-up. Of the remaining 12 limbs (10 patients), the mean duration of follow-up was 54 months (range, 42-70 months). No symptomatic expansion of the excluded aneurysms was noted. Secondary interventions were required in two limbs (16.7%). One patient developed a type I endoleak at 18 months and a type III at 29 months because of endograft migration. The other patient developed a type I endoleak at 23 months with