rupture, dilatation under high pressure was not performed. A small space between the stent and the aortic wall remained because of the protruding calcified lesion of the aorta. This space caused thrombus formation under the stent. When selecting the stent, we did not have a choice because the Wallstent was the only stent available at that time under an investigational protocol sponsored by the Japanese Ministry of Health and Welfare.

Stents with a higher hoop strength, such as the Palmaz stent, might be a better choice. However, incomplete expansion of the balloon-expandable Palmaz stent might also occur, considering the heavily calcified, eccentric, protruding lesion in this patient. Incomplete expansion of the Palmaz stent may cause serious problems such as migration of the stent due to malaposition to the aortic wall. When the attachment of a native artery to the stent is not perfect, thrombus may fill in the space between the vessel wall and the stent struts. This case suggests that complete attachment of the stent to the arterial wall is fundamental to prevent in-stent restenosis and stent thrombosis.

References

Treatment of Popliteal Artery Aneurysms with Uncovered Wallstents

Mariano De Blas,1 Santiago Merino,1 Francisco Ortiz,2 Juan Egana,2 Mary Beth Lobrano,3 Jorge Lopera,3 Arturo Gonzalez,2 Manuel Maynar3

1Department of Radiology, Hospital De Guipuzcoa, P.del Dr. Beguiristian, E-20080 San Sebastian, Spain
2Department of Surgery, Hospital De Guipuzcoa, P.del Dr. Beguiristian, E-20080, San Sebastian, Spain
3Division of Vascular Interventional Radiology, LSU Medical Center, 1542 Tulane Avenue, Room 307, New Orleans, LA 70112, USA

Abstract
We report two patients with acutely thrombosed popliteal artery aneurysms that were successfully treated with a combination of thrombolytic therapy and placement of uncovered Wallstents.

Key words: Popliteal artery aneurysms—Metallic stents—Thrombolysis

Popliteal artery aneurysms (PAA) carry a relatively low risk of rupture; however, complications occur with a reported incidence between 35% and 61% [1]. The most frequent of these complications are thrombosis and embolization, leading to amputation in 20%–50% of cases [2]. The use of thrombolysis prior to surgery has been advocated by several authors as an initial treatment for patients presenting with acute limb ischemia secondary to thrombosis of PAA or to distal embolization. The efficacy of thrombolytic therapy in converting the urgent bypass with poor runoff to an elective procedure with good runoff has led to the widespread adoption of thrombolysis [3].

We report two patients who presented with severe limb ischemia related to a thrombosed PAA who were successfully treated with a combination of thrombolytic therapy and uncovered Wallstents.

Case Reports
Case 1
A 65-year-old man presented with a 48-hr history of acute onset right lower extremity rest pain. No pulses were palpable distal to the right femoral pulse.
One year prior to this admission surgical repair of a right PAA was performed, using a synthetic end-to-end interposition graft replacing the middle segment of the popliteal artery (PA). An ipsilateral downstream arteriogram showed complete occlusion of the superficial femoral artery (SFA) at the level of the adductor canal. Deep femoral artery collaterals reconstituted the distal PA continuous with the tibioperoneal trunk, and the peroneal artery was the sole trifurcation runoff vessel. After consultation with the vascular surgeon and the interventional radiologist, the patient declined surgical intervention.

Cather-directed thrombolysis was performed, infusing urokinase at 100,000 U/hr. A follow-up arteriogram at 20 hr showed a patent bypass graft with an aneurysm of the distal SFA and PA proximal to the graft containing residual mural thrombus (Fig. 1A). A 50%-60% stenosis was identified at the level of both the proximal and distal anastomoses of the bypass graft (Fig. 1B). After the urokinase infusion, angioplasty of the proximal and distal graft anastomoses was performed successfully using a 7-mm-diameter, 2-cm-long angioplasty balloon. Subsequently, two Wallstents, 10-mm in diameter, and 75 and 125 mm in length, respectively (Schneider, Inc., Plymouth, MN, USA) were placed at the proximal anastomosis to exclude the existing mural thrombi and the aneurysmal segment; 30% stent overlap was obtained. The follow-up angiogram showed good flow through the 8-mm-diameter stented channel with minimal leakage through the mesh of the Wallstents into the aneurysmal sac (Fig. 2). No complications occurred during the procedure. The patient was anticoagulated with heparin, 1250 U/hr for 48 hr, followed by 7 days on low molecular weight heparin, at 40 mg/day. The patient was then placed on oral aspirin, 300 mg/day.

The ankle-brachial index (ABI) returned to 1.0 and a color Doppler sonogram 24 hr after the procedure showed a luminal diameter of 8 mm for the endoprosthesis and 22 mm for the aneurysmal sac around the endoprosthesis. No blood flow was detected within the thrombosed aneurysm.

At 47 months, the patient remained asymptomatic with an ABI of 1.0. An arteriogram showed patency of the endoprosthesis without leak into the aneurysm, and formation of a 1-mm neointima along the length of the stent (Fig. 3). Color Doppler sonography confirmed retention of an 8-mm luminal diameter.

Case 2

A 65-year-old man presented with acute left lower extremity ischemia. Pulses were absent below the knee. His past medical history included a coronary bypass graft and amputation of the right lower extremity second-

The patient refused surgical treatment. After discussion with the vascular surgery service, three Wallstents (Schneider), 10 mm in diameter, 125 mm in length, and an additional 10-mm × 75-mm Wallstent, were placed to cover the entire length of the aneurysm (Fig. 4B). Angiography after stent deployment showed patency of the treated segment with a 9-mm-diameter stented channel lumen and only minimal leakage through the mesh of the endoprosthesis into the aneurysm.

The patient was maintained on heparin, 1250 U/hr, for 7 days followed by coumadin at therapeutic levels with an INR of 3. A color Doppler sonogram 24-hr poststen deployment demonstrated an endoprosthesis luminal diameter of 9 mm, and an aneurysmal sac diameter around the endoprosthesis of 21 mm. Mural thrombus was seen between the stent and the vessel wall without evidence of leakage. The ABI was 1.0.

Angiographic follow-up at 11 months showed loss of overlap of the two proximal endoprostheses with recurrence of the aneurysm at this site (Figs. 5A, B). Reintervention was necessary with placement of an additional self-expanding 10-mm × 75-mm endoprosthesis across this level (Fig. 5C). Follow-up color duplex ultrasound 25 months after the initial stent placement showed excellent flow through the endoprostheses with complete exclusion of the aneurysm. The ABI remained 1.0.

Discussion

Acute thrombosis of a PAA can cause severe ischemia of the lower extremity, particularly when associated with extension of thrombosis and/or embolization into the tibioperoneal arteries. In patients with PAA and involvement of the distal vascular bed by thrombus, the surgical treatment is less effective than in those patients in whom surgery is performed as an elective procedure with an adequate distal runoff [3, 4]. Similarly, the amputation rate increases significantly in patients with acute limb ischemia due to thrombosis of popliteal artery aneurysms [2, 5].

The role of surgical bypass is widely accepted for PAAs larger than 2 cm with mural thrombus and for those patients presenting with claudication, digital atheroembolism, and critical limb ischemia [3]. There is controversy over the treatment of patients with asymptomatic PAAs. Many centers recommend an elective repair of nonsymptomatic PAAs because of the minimal amputation rate associated with this surgery, whereas a high amputation rate is noted in patients once symptoms develop [5]. Other authors, however, recommend conservative management of the asymptomatic patient with a PAA especially if there is a high surgical risk or the patient refuses surgery [2, 6].

In the two cases reported here, the use of thrombolytic therapy led to successful treatment of the acute ischemia, significantly improving the distal runoff. In both cases, color Doppler sonography post-thrombolysis showed the existence of extensive residual mural thrombus in the lumen of the aneurysm. The standard therapeutic conduct mandated the surgical exclusion of the aneurysms; however, both patients refused surgical treatment. After consultation with the vascular surgery service, we elected to deploy self-expandable, flexible endoprostheses in order to exclude the lumen of the aneurysms, thus preventing subsequent events of distal embolization. Although extravasation of contrast medium could be seen through the mesh of the endoprosthesis immediately after deployment, subsequent color Doppler sonography and angiographic examinations confirmed the complete exclusion of the aneurysmal sac. In our two patients, recurrence of local thrombosis and/or distal embolization was prevented and complete exclusion of the aneurysm occurred following the use of the endoprostheses. In one of the cases, persistent filling of the aneurysm sac was noted in a follow-up angiogram 11 months after the procedure. This initial clinical failure was related to loss of the overlap between the stents. Because the stents are deployed into an ectatic vascular segment with mural thrombus, 1–1.5 cm overlap of the ends of adjacent endoprostheses appears to be necessary, since compression of mural thrombus allows further expansion of the stents with concomitant shortening. Sufficient overlap will prevent separation of the ends of the endoprostheses with subsequent recurrence of the aneurysm.

Although the patency of most peripheral arterial stents is limited, most commonly because of intimal hyperplasia [7], the popliteal stents placed in our patients remained patent at 25 and 47 months. These encouraging results are probably related to the large size of the stented arteries.

The long-term follow-up by color Doppler sonography and/or angiography in our patients did not show any evidence of further increase in the diameter of the lumen of the aneurysmal segment.