Peripheral atherectomy is a resurgent and exciting treatment as an alternative to lower extremity arterial bypass for treatment of superficial femoral artery (SFA) disease in symptomatic patients with critical limb ischemia and disabling claudication. Long-term efficacy of these endovascular techniques remains to be established. However, the endovascular options such as atherectomy are often appealing since they are associated with a lower peri-procedural morbidity and mortality. With the availability of the SilverHawk (FoxHollow Technologies Inc., Redwood City, Calif) atherectomy device, there has been a renewed interest in the atherectomy technique.

Common early complications related to this device include need for emergency access site surgery, retroperitoneal hemorrhage, vascular perforation, or plaque dissection. A pseudoaneurysm formation at the atherectomy site in the native artery has not been reported in the noncoronary literature. We report a case of a patient who developed a large pseudoaneurysm in the segment of SFA treated by atherectomy.

CASE REPORT

A 45-year-old woman who presented with blue toe syndrome was treated with atherectomy for a focal plaque located in the superficial femoral artery. She subsequently developed a large pseudoaneurysm at the atherectomy site requiring multiple sequential endovascular procedures in order to maintain in-line blood flow to the foot. Pseudoaneurysm formation at native peripheral artery atherectomy site has not been reported previously. We discuss possible complications of atherectomy and the possible mechanism of pseudoaneurysm formation after atherectomy. We address the importance of understanding risks of these minimally invasive procedures along with planning follow-up duplex and potential bail-out tactics. (J Vasc Surg 2007;46:565-8.)

A 45-year-old woman with 30-pack per year history of smoking was referred to our hospital with complaints of bluish discoloration of left great toe with burning pain. Physical examination revealed dusky discoloration of the toes and hyperesthesia. The ipsilateral pedal pulses were palpable. Multiple angiographic projections revealed a localized complex plaque in the left mid-SFA as a cause of distal embolization (Fig 1).

The lesion was treated with atherectomy carried out using the SilverHawk atherectomy catheter (LS cutter) via contralateral femoral approach. Multiple passes of the catheter were used to excise the complex plaque in the left mid-SFA, while an Accunet (Abbott Laboratories, Abbott Park, Ill) embolic protection device was positioned in the popliteal artery. Each pass of atherectomy spanned a distance of 6 to 7 cm. At completion of atherectomy, irregularities were noted in the vessel wall proximal and distal to the main lesion (Fig 2). These irregularities were treated with placement of a short nitinol self-expanding SMART (Cordis Corporation, Miami Lakes, Fla) stent (7 mm × 40 mm). Balloon angioplasty was not performed.

Patient was discharged on the first postoperative day with palpable pedal pulses. On the third postoperative day, she developed leg edema and was treated with fractionated heparin and warfarin for a diagnosis of deep vein thrombosis (DVT). Duplex examination revealed left popliteal vein DVT with an aneurysmal SFA measuring 2 cm in maximum diameter. She was seen in the clinic in 1 week and again in 3 months with improvement of edema.

At the 4-month follow-up visit, her left SFA was found to have a maximum diameter of 2.8 cm. Angiography revealed a bi-lobed pseudoaneurysm distal to the stent in the atherectomized zone of SFA (Fig 3). The pseudoaneurysm extended over an 8 cm segment of the SFA. This was treated with placement of 7 mm × 10 cm and 7 mm × 5 cm Viabahn endoprostheses (W. L. Gore & Associates, Inc, Flagstaff, Ariz) with successful exclusion of the pseudoaneurysm (Fig 4). At the 6-week follow-up visit after the secondary procedure, there was evidence of in-stent stenosis of the Viabahn stent with peak systolic velocity of 250 cm/s and a fall in ABI to 0.7. This was treated by balloon angioplasty with no residual stenosis. Warfarin was discontinued at this stage due to completion of DVT treatment, but she was continued on aspirin and clopidogrel.

One week later, she returned with sudden onset of rest pain in left forefoot with dusky discoloration. Angiography demonstrated occlusion of the Viabahn stent (Fig 5). In view of the small caliber of her saphenous vein and patient preference, this was treated with mechanical thrombectomy and placement of self-expanding stents in SFA and the popliteal artery. This included placement of a stent within the Viabahn endoprostheses as an attempt to salvage the in-line flow to the leg (Fig 6). Warfarin was resumed empirically but no hypercoagulable state was identified.
At the 1- and 4-month follow-up visits after the last intervention, she has remained asymptomatic. Her duplex showed patent left SFA stents and ankle-brachial index was 1.0.

DISCUSSION

A variety of new interventional tools are being added to the armamentarium of physicians involved with endovascular interventions. Interest for atherectomy has waxed and waned over the last few decades with several devices enjoying popularity primarily in the 1990s. The SilverHawk peripheral plaque excision system received FDA approval for use in peripheral vasculature based upon similarities with the previously approved Simpson AtheroCath® (DVI, Redwood City, Calif) and has received marked enthusiasm in recent years. Randomized trials have shown higher restenosis rates with Simpson AtheroCath compared with angioplasty alone while the long-term restenosis rates for the SilverHawk system remain to be determined.

While the debate over the long-term utility of this technique continues, interventionalists face an occasional...
local complication with the atherectomy devices. The national multicenter registry for tracking outcomes with the SilverHawk System (TALON) (FoxHollow Technologies Inc.) has reported minor complications such as perforation (0.8%) and dissection (3.6%) with rare reports of distal embolism, thrombosis, abrupt closures, or re-occlusions.\(^1\) Arterial media and adventitia was found frequently on histologic examination of specimen after peripheral atherectomy in vein grafts with one case of pseudoaneurysm formation reported in the treated vein graft segment.\(^9\) Atherectomy samples from peripheral arteries have been found to contain adventitia in only 1% specimens with medial component in 21% of specimens.\(^10\) We do not routinely send the atherectomy specimen for histopathologic analysis at our institution due to lack of concordance between histology and future formation of pseudoaneurysm.

Development of a pseudoaneurysm in coronary artery after atherectomy\(^8\) has been reported as a rare occurrence. Histologic specimens from coronary atherectomy have been found to contain media in 67% and adventitia in 27% of specimens with infrequent clinical sequelae.\(^9\) Arterial media and adventitia was found frequently on histologic examination of specimen after peripheral atherectomy in vein grafts with one case of pseudoaneurysm formation reported in the treated vein graft segment.\(^9\) Atherectomy samples from peripheral arteries have been found to contain adventitia in only 1% specimens with medial component in 21% of specimens.\(^10\) We do not routinely send the atherectomy specimen for histopathologic analysis at our institution due to lack of concordance between histology and future formation of pseudoaneurysm.

Our patient developed a pseudoaneurysm of the treated segment of the SFA probably as a result of debulking and unintentional atherectomy of relatively normal intima proximal and distal to original lesion, which weakened the arterial wall. This led to progressive degeneration and enlargement of the vessel under arterial pressure. Pathophysiologically, this is likely to be similar to aneurysmal degeneration of dissections. Natural history of iatrogenic pseudoaneurysms being unknown, we initially decided to follow it closely.

Mechanical factors have been implicated in causation of trauma to the vessel wall during atherectomy. These include tortuous nature of the vessel, oversized atherectomy device, lesions close to prior surgical scar, and location of a lesion near side branches.\(^11\) These factors are likely to alter the depth of cut in the vessel wall predisposing to a weakness in the wall. Our patient had the lesion close to a branch vessel. Stresses due to the junction of mobile and immobile vessel segments at branch points may have predisposed to deeper cuts with the atherectomy device. A combination of above mentioned factors may make deeper cuts even more likely. Cadaveric studies have demonstrated difficulty in intentionally perforating or cutting through arteries with atherectomy device unless there was additional external compression and multiple passes of the device were made.\(^10\)

The initial lesion is a TransAtlantic InterSociety Consensus (TASC) A lesion and is only moderately calcified. An endovascular option was chosen along the lines of TASC II recommendations to tackle the embolic source of blue toe syndrome. Secondary to unforeseen complications, she needed multiple endovascular interventions in order to preserve the in-line blood flow through the femoro-popliteal segment. Many of the endovascular techniques are still faced with inability to establish long-term patency as of now.\(^2\) Endovascular surgeons must recognize these risks, arrange appropriate follow up imaging where needed, and plan for bail-out procedures.

REFERENCES


Submitted Jan 19, 2007; accepted April 16, 2007.

We have the answers you are looking for.

VascularWeb
One Source for Vascular Health Information

Visit us at:
http://www.vascularweb.org