Treatment of abdominal aortic anastomotic pseudoaneurysm with percutaneous coil embolization

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Intraabdominal anastomotic pseudoaneurysms continue to be a late complication of aortic reconstructive procedures. Early surgical repair is critical but is associated with high operative mortality rates. We present a patient who was diagnosed with a distal anastomotic pseudoaneurysm 13 months after transabdominal repair of a symptomatic abdominal aortic aneurysm. Because of the poor operative risk, the patient was considered for a less invasive approach and underwent coil embolization of the abdominal aortic anastomotic pseudoaneurysm. The patient remains without recurrence of pseudoaneurysm 3.5 years later. (J Vasc Surg 2002;35:811-4.)

Paraanastomotic pseudoaneurysm continues to be a late complication of abdominal aortic reconstruction for occlusive or aneurysmal disease. Recognized more frequently, these pseudoaneurysms, and paraanastomotic true aortic aneurysms, are associated with high morbidity and mortality rates.[1-3] Developments in endovascular technology have resulted in effective stent grafts for the treatment of thoracic and abdominal aortic aneurysmal disease. One complication of these techniques is incomplete exclusion or endoleaks, which, if untreated, may result in aneurysm rupture. To address this complication, novel endovascular methods have been successfully used.[4-10] With increased experience in endovascular treatment of aortic and arterial aneurysms and their complications, we present a case of a patient who underwent treatment with coil embolization of a intraabdominal pseudoaneurysm at the distal anastomosis of a previously surgically repaired abdominal aortic aneurysm.

CASE REPORT

The patient was a 76-year-old man with chronic obstructive pulmonary disease (with supplemental oxygen and steroid therapy), cor pulmonale, coronary artery disease with stable angina, hypothyroidism, prostate carcinoma with previous hormone and radiation therapy, and history of right pneumonectomy for carcinoma. Four and one half years previously, the patient had had lower abdominal pain develop that radiated to the back. Computed tomographic (CT) scan results showed a 6.2-cm fusiform infrarenal abdominal aortic aneurysm that extended to the aortic bifurcation. There was no evidence of rupture; the iliac arteries were markedly calcified without aneurysmal disease. The patient underwent surgical repair of a symptomatic abdominal aortic aneurysm via a transperitoneal approach. An 18-mm Hemashield knitted Dacron tube graft (Meadox Medicals, Inc, Oakland, NJ) was used with the proximal anastomosis at the infrarenal neck of the aneurysm and the distal anastomosis at the level of the aortic bifurcation. The proximal and distal anastomoses were performed with 3-0 polypropylene sutures. The aneurysm sac was wrapped around the graft. After surgery, the patient had a left lower lobe pneumonia, which was treated with intravenous antibiotics. The patient underwent successful extubation on postoperative day 11. Therapy was continued with tapering doses of methylprednisolone and supplemental oxygen at 2 L/min. The patient was transferred to the rehabilitation ward and was discharged 1 month later with prednisone therapy.

Thirteen months after the repair of the abdominal aortic aneurysm, the patient was admitted with a 1-month history of mild abdominal pain and a pulsatile abdominal mass. The patient's condition was hemodynamically stable with no fevers or chills. The patient remained on supplemental oxygen therapy. Medications included prednisone (12.5 mg per day), thyroid replacement, isosorbide dinitrate, furosemide, trimethoprim/sulfamethoxazole, and bronchodilators. The patient was afebrile, with a blood pressure of 128/78 mm Hg and a heart rate of 90 beats/min. Abdominal examination results showed a moderately tender pulsatile mass. The white blood cell count was 4.1 K/mm^3 with a hematocrit of 29.5%. Sodium level was 143 mEq/L, potassium level was 3.5 mEq/L, chloride level was 107 mEq/L, bicarbonate level was 29 mEq/L, blood urea nitrogen level was 3 mg/dL, and creatinine level was 0.5 mg/dL. CT angiographic results showed the intraabdominal pseudoaneurysm measuring 8.5 cm in its maximal diameter. The location and size of the neck of the pseudoaneurysm could not determined on the basis of this study. The presence or absence of infection could not be determined. Pulmonary function test results showed a forced expiratory volume in 1 second of 1.0 L and forced vital capacity of 1.7 L. Blood cultures showed no growth.

With the patient's poor surgical risk, we elected to angiographically evaluate the pseudoaneurysm with a consideration for endovascular repair. In the angiography suite, the right femoral

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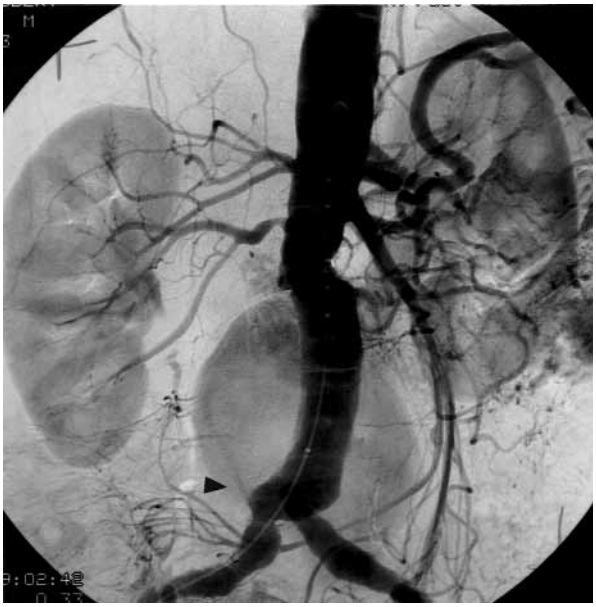

Fig 1. Angiogram of abdominal aorta shows small leak *(arrowhead)* at distal anastomosis of aortic tube graft with enhancement of pseudoaneurysm.

Fig 2. Angiogram of abdominal aorta after coil embolization of site of leak at distal aortic anastomosis. Leak is no longer visualized.

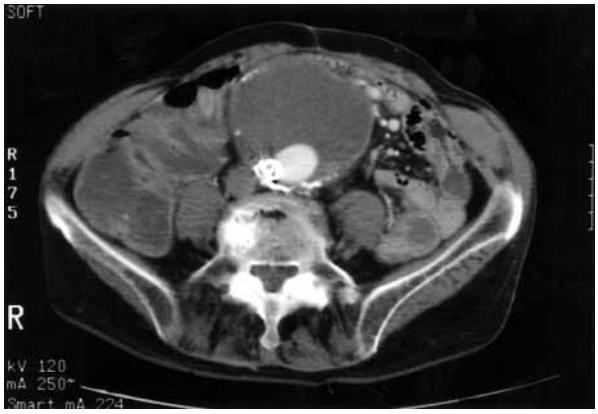

Fig 3. Follow-up computer tomographic angiography shows site of coil embolization and exclusion and thrombosis of pseudoaneurysm.

artery was accessed percutaneously and a 6F sheath was placed. After passage of a 5.5F catheter into the upper abdominal aorta, angiographic results showed an apparent small defect at the right lateral aspect of the distal anastomosis (Fig 1). The size of the communication site was inferred from the angiographic evaluation and with engagement of the catheter tip in the aneurysm neck. Because of the small size of the defect, endovascular coil embolization was attempted. The catheter was exchanged for a 5F Berenstein catheter, followed by a 4F C2 catheter. The defect at the anastomosis was traversed with the guidewire, and the 4F catheter was advanced through the hole. Through this 4F catheter, five coils were deployed across the point of leakage (three 8-mm diameter coils and two 15-mm coils; Cook Medical, Bloomington, Ind). The first 8-mm coil was misdeployed into the sac of the pseudoaneurysm. The tip of the catheter was repositioned at the neck of the pseudoaneurysm. The remaining coils were deployed, bridging the defect in the wall of the aorta so that the initial turns of the helix fell within the pseudoaneurysm and the final turns of the helix fell within the lumen of the vessel. The number of coils used was on the basis of selective angiographic injections after each coil placement for the determination of any residual leak. Postprocedure angiographic results showed complete pseudoaneurysm exclusion (Fig 2). After coil embolization, the patient's abdominal pain resolved during the next 24 hours. Results of an abdominal ultrasound scan 2 days later showed no flow into the excluded pseudoaneurysm. Results of a follow-up angiogram just before discharge showed no evidence of leak at the embolization site. The patient was discharged at 1 week later. Results of a follow-up CT scan at 4 weeks showed no contrast extravasation into the excluded pseudoaneurysm (Fig 3).

Seventeen months after the endovascular embolization, the patient was admitted for recurrent pneumonia. Because of worsening pulmonary function, a tracheostomy was performed. At 3.5 years after coil embolization of the aortic pseudoaneurysm, the patient was alive with supplemental oxyen via a tracheostomy. Abdominal duplex ultrasound scan examination results showed an excluded aneurysm sac measuring 5 cm with no flow into the sac.

DISCUSSION

Anastomotic and paraanastomotic aneurysms after abdominal aortic reconstruction are becoming more frequently recognized.[1-3] Edwards et al[2] followed 111 patients

with abdominal aortic grafts and found seven patients with intraabdominal anastomotic pseudoaneurysms. Of these pseudoaneurysms, five were at the aortic anastomoses, one was at the iliac anastomosis, and one was at the proximal aortorenal anastomosis. The mean time from operation to time of diagnosis was 144 months (range, 8 to 336 months). Pseudoaneurysms typically developed late, with an incidence rate of 5% at 8 years and of 27% at 15 years, and tended to be more frequent after operation for occlusive disease rather than for aneurysmal disease. Three patients underwent successful repair, and four were followed because the patient either refused surgery or was of poor operative risk.[2] Allen et al[3] compiled a study of 29 patients in whom anastomotic or paraanastomotic aneurysms developed after previous abdominal aortic reconstruction. The aneurysm was at the proximal anastomosis in 27 patients and at the distal anastomosis in two patients. Sixteen patients underwent treatment with surgical revision with an interposition graft, nine underwent aortoiliofemoral bypass grafting, and three needed graft removal with extraanatomic bypass grafting. In spite of prompt diagnosis and surgical intervention, the overall operative mortality rate remained substantial at 21%.[3]

Endovascular stent grafting of abdominal aortic aneurysms has emerged as an alternative to surgical treatment in selected patients. Endoleak, considered a procedural failure, is a complication of this approach and can result in continued aneurysm growth and potential rupture.[4-9] Amesur et al[4] found that, of the 54 patients who underwent treatment with endovascular repair of abdominal aortic aneurysm, 21 patients had endoleaks develop, seven of which persisted at 6 months. Six patients underwent successful endovascular embolization with resolution of the endoleaks. Gorich et al[6] reported a 20% incidence rate of endoleaks in 55 patients who underwent endovascular stent grafting of aortic aneurysms. Of these 11 patients, seven underwent coil embolization with endoleak resolution. Although endoleaks can be approached with a combination of coil embolization of the perigraft space and embolization of outflow vessels, the intraaneurysmal pressure may remain elevated and thus subject the aneurysm to a continued risk of rupture.[8] Marty et al[8] evaluated a canine model of endovascular stent grafting of the abdominal aorta and the coil embolization of endoleaks. In spite of angiographic and CT scan evidence of "sealing" of endoleaks, measurement of the intraaneurysmal pressure showed a persistently elevated ratio of intraaneurysmal pressure to systolic blood pressure of 0.76.[8] Therefore, the fate of endoleaks after coil embolization is not clear, and the effectiveness of such an approach requires long-term follow-up examination and possibly direct measurement of intraaneurysmal pressure as suggested by Baum et al.[7]

Because of the limitations of angiography and CT scanning in the assessment of the physiology of endoleaks after endovascular intervention, the optimal imaging method for following these patients remains controversial. Wolf et al[9] reported that duplex ultrasound scanning was comparable with CT angiography for the assessment of the aneurysm size, endoleaks, and graft patency after endovascular exclusion of abdominal aortic aneurysm. Compared with CT scan in the assessment of endoleaks, duplex scanning had a sensitivity of 81%, a specificity of 95%, a positive predictive value of 94%, and a negative predictive value of 94%.[9] In the patient in this report, serial duplex ultrasound scan evaluations were obtained after an early postprocedure angiogram and CT scan at 1 month. Follow-up ultrasound scan examination results showed progressive diminution in the size of the aneurysm sac from 8.5 cm at the time of endovascular intervention to 5 cm at 3.5 years. Less traumatic or endovascular techniques for the treatment of anastomotic complications appear attractive in highly selected patients at poor surgical risk, but they do have certain anatomic constraints and limitations. For instance, in this case, the neck or communication site of the pseudoaneurysm appeared relatively small so that coil embolization could successfully eliminate the inflow of the pseudoaneurysm. Analogously, the configuration of the endoleaks, such as size and length of the channels, is predictive of the response to endovascular intervention as reported by Mehta et al[10] in an ex vivo evaluation.

Conventional imaging methods, such as angiography and CT scanning, may not provide a definitive measurement of the size of the defect. Perhaps intravascular ultrasound scanning may prove of value in this regard. The small size of the communication site in this patient was inferred from the angiographic evaluation and with engagement of the catheter tip in the pseudoaneurysm neck. The small size of the defect was supported by the fact that the coils could be placed without displacement. In a situation in which the anastomotic defect is larger, embolization may not be effective and a short endovascular stent graft may be necessary for an adequate seal. If the aortic graft were infected as suggested with CT scan or positive blood culture results, an endovascular approach would not be appropriate and open surgical revision would be necessary. Although endovascular techniques may provide alternative means to conventional surgical repair of anastomotic complications in patients who are at poor operative risk, current follow-up examination remains limited. Because the pressure within the pseudoaneurysm sac may remain elevated in spite of endovascular coil embolization as previously reported in the treatment of endoleaks, longer follow-up examination is mandatory before such an approach is considered curative.

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