CASE REPORT

Treating a Carotid Artery Vein Patch Aneurysm Using the Viabahn Endoprosthesis

A look at this endovascular tool and a review of literature on carotid artery aneurysms.

BY LARRY HORESH, MD, AND JERRY COHN, MD

Carotid aneurysms of the extracranial carotid artery are rare and account for 0.4% to 1% of all aneurysms.1-3 The various etiologies include atherosclerosis, pseudoaneurysms, and aneurysmal dilation from a previous carotid endarterectomy (CEA), traumatic lesions, and more rarely fibromuscular dysplasia, Takayasu’s arteritis, neurofibromatosis, and Behçet disease.4-7 Neurological symptoms are common, occurring in 14% to 70% of patients, with additional symptoms of cranial nerve compression in some patients.1-3,8 Nonoperative treatment in various series is associated with significant stroke/death rates as high as 50% to 70%.2,8 Traditional operative treatment of carotid ligation is associated with a high incidence of stroke and death. In the historic review of 106 extracranial carotid aneurysms, Winslow described an operative mortality rate of 30% associated with carotid ligation.8 The high incidence of complications related to ligation was likely from extension of occlusion into the intracranial vessels in an era when vascular surgery was performed without anticoagulation. Reconstructive surgery is often difficult with a high incidence of cranial nerve injury and stroke.1,3

In this case report, we describe a patient with previous CEA and vein patch repair of the right internal carotid artery who had subsequent neck exploration and dissection for base-of-tongue cancer. He was additionally treated with radiation therapy. He presented to our department 7 years later with an enlarging right carotid artery aneurysm containing a large amount of thrombus. The patient was successfully treated with a Viabahn endoprosthesis (Gore & Associates, Flagstaff, AZ).

CASE REPORT

A 63-year-old man presented with an uncomfortable pulsatile mass in his right neck. He had a right CEA with vein patch repair 10 years previously. He subsequently developed head and neck cancer requiring right neck dissection with glossectomy and radiation therapy of the right neck 7 years previously. Several months prior to presentation, the patient noted progressive enlargement of the pulsatile mass in the right neck. A CT scan demonstrated a large pseudoaneurysm arising from the level of the right common carotid artery and progressing to a patent right common carotid artery patch. A large amount of irregular thrombus was present in the 2.5-cm pseudoaneurysm, with the normal right common carotid artery measuring approximately 6 mm (Figure 1). The institutional review board is not required for this type of case at our institution; however, detailed informed consent was obtained from the patient and family. The patient and our service believed the risks of endovascular repair were less than operative intervention.

The patient was treated with clopidogrel 75 mg/d and aspirin 325 mg/d for 2 weeks prior to the procedure.

Figure 1. Pre-treatment CT scan demonstrating a large aneurysm extending from the right common carotid artery containing a large amount of thrombus.
Intravenous cefazolin (1 g) was administered immediately before the procedure. Anticoagulation was achieved with a bivalirudin weight-adjusted bolus and continuous drip. Complete angiographic evaluation of the arch and intracerebral circulation was performed (Figure 2). An 8-F Shuttle sheath (Cook Medical, Bloomington, IN) was placed over a 6.5-F, H1 select (Cook Medical), 125-cm catheter using the telescoping technique into the right common carotid artery to the level of the clavicle. The patient had previous intervention for his head and neck cancer, skeletonizing the external carotid artery with previous ligation of the superior thyroid, ascending pharyngeal, and lingual branches. A 125-cm, 5-F vertebral catheter (Cordis Corporation, a Johnson & Johnson company, Miami, FL) was placed in the internal maxillary and ascending trunk of the right external carotid artery, and both branches were embolized with 4-mm Nester coils (Cook Incorporated) protruding into the main right external carotid trunk (Figure 3A). A Tad II wire (Mallinckrodt Corporation, St. Louis, MO) was placed through the vertebral catheter after it was carefully placed to the level of the skull base.

Two overlapping Viabahn stent grafts, measuring 5 mm X 5 cm distally and 6 mm X 5 cm proximally, were placed over the Tad II wire, achieving 2 cm of seal zone in the internal carotid artery and 2 cm of seal zone in the common carotid artery with a total of 6.5 cm of stented artery. Using a second BMW wire (Guidant Corporation, St. Paul, MN), a 4.5-mm X 2-cm Sterling balloon (Boston Scientific Corporation, Natick, MA) and a 6-mm X 2-cm Sterling balloon were utilized to dilate the distal and proximal segments. Final angiography demonstrated complete aneurysm exclusion with excellent stent apposition to the arterial walls (Figure 3B). The aneurysm was no longer pulsatile, and the neurological examination yielded normal findings. Follow-up ultrasonography confirmed wide patency, with exclusion of the aneurysm with significant decrease in size to 2 cm.

**DISCUSSION**

CEA is the most common vascular surgery operation with excellent results that challenge the acceptance of carotid stenting. Patch closure repair significantly decreases the incidence of restenosis from 10% to 20% to only 1% to 3%.9,10 CEA with vein patch repair benefits were clearly demonstrated in the Cleveland Clinic experience, but the lesser tensile strength of lower-leg saphenous vein was also noted. Aneurysmal dilation of the repair, however, can occur with both PTFE closure or vein patch closure and has been reported to occur in up to 9% of PTFE closures and 17% of saphenous vein patch repairs.11,12 To avoid aneurysmal dilation with the deposition of thrombus, care must be taken to restrict the width of the patch to no more than 5 mm to 8 mm.

The largest evaluation of carotid aneurysms has been by the Texas Heart Institute with additional large series submitted from the University of Michigan and Baylor University.1-3 El-Sabrout et al found 38 pseudoaneurysms after previous carotid surgery and 29 atherosclerotic or traumatic aneurysms. The incidence of neurologic symptoms in the atherosclerotic aneurysms and pseudoaneurysms was between 30% and 50%, underscoring the likely natural history of aneurysmal dilation of the carotid artery. The Baylor University series by McCollum et al13 identified 37 aneurysms with 15% presenting with neurologic symptoms. The University of Michigan experience cited a 50% stroke rate with nonoperative management.2 The historic evaluation of carotid aneurysms by Winslow reported a 71% all-cause mortality with carotid aneurysm complications followed nonoperatively.8

The operative incidence of all stroke or death in various series ranged from 10% to 20% with a 5% to 20% incidence of cranial nerve palsy.1,3,13 In an evaluation by Lumsden et al of 22 patients treated surgically between 1985 to 1994, the incidence of cranial nerve injury was 14%, and the major stroke/death rate was 14%.14 The complications are related to the difficulty of exposing the carotid artery in an often hostile neck with an aneurysm that contains large amounts of thrombus and surrounding inflammatory changes.
In the setting of postcarotid endarterectomy restenosis, carotid artery stenting demonstrated 50% reduction in all complications compared to redo surgery. The strategy of carotid artery stenting was largely adopted for carotid restenosis despite the fact that symptoms arising from restenosis are rare and as low as 2%. In the setting of carotid aneurysms, both the natural history and operative risks are considerable, making endovascular repair attractive. Various forms of cerebral protection can be obtained endovascularly, and good results are seen in the literature with sporadic reports of endovascular management of carotid aneurysms.

Initial endovascular management of traumatic pseudoaneurysms depended on a narrow neck and included transscatether carotid occlusion, placement of closed-cell stents with remodeling, closing the pseudoaneurysm, coil placement with bare-metal stents, and even balloon occlusion protection with thrombin injection again with a narrow neck. Covered stents are, however, required for large-neck aneurysms. Initial cases were limited to “homemade” devices that invariably used balloon-expandable stents.

The use of balloon-expandable stents is limited to areas free from external compression or extensive motion. However, the commercially available Jostent (Abbott Vascular, Abbott Park, IL) was used successfully in several cases. Polyethylene terephthalate-covered Wallgrafts (Boston Scientific Corporation) were then utilized successfully in several reports. Several reports of Wallgraft restenosis in iliac arteries, superficial femoral arteries, and then carotid arteries have entered the literature.

The Viabahn endoprosthesis appears to have the best performance and was therefore chosen as the best option for repair. The Viabahn stent graft has been successfully utilized by Powell et al from Dartmouth and by operators from Texas Heart.

In this report, we repaired a 2.5-cm common carotid artery aneurysm with a large amount of irregular thrombus in a patient with a hostile neck from previous CEA, radical neck surgery, repeat neck dissection, and radiation therapy. We chose the Viabahn endoprosthesis secondary to its excellent results in other vascular beds susceptible to external forces. Additionally, there are case reports of Wallgraft endoprosthesis restenosis and migration. A recent report from Duke demonstrated 50% to 100% restenosis in three out of four patients. We had the option of using filter wires with a double-wire technique versus meticulous technique with detailed understanding of the location of the thrombus and chose the latter in this scenario in which only after placement of covered stents postimplant dilatation was being performed.

CONCLUSION

In the setting of carotid artery aneurysms with a poor natural history prognosis consisting of stroke and death and difficult surgical treatment, endovascular stent-grafting will likely emerge as the treatment of choice similar to this case report. Further studies are needed, however.

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