Transradial stenting of a carotid pseudoaneurysm

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ABSTRACT

Carotid pseudoaneurysms are rare and, if treated endovascularly, are usually approached via the femoral artery. We report the case of transradial stenting of an anastomotic carotid pseudoaneurysm secondary to vertebral transposition through an existing carotid-subclavian bypass. (J Vasc Surg Cases and Innovative Techniques 2019;5:54-7.)

Keywords: Carotid aneurysm; Carotid pseudoaneurysm; Radial access; Stent; Endovascular

Carotid aneurysms and pseudoaneurysms can be treated successfully with both open surgical techniques and endovascular repair.[1] Femoral arterial access is standard if the latter modality is chosen, but can be challenging in the setting of prior aortic arch surgeries or coexisting pathology in the descending aorta. We present a patient who developed an anastomotic pseudoaneurysm secondary to a vertebral-carotid transposition and was treated transradially through an existing carotid-subclavian bypass. Patient consent for the publication of case details was obtained.

CASE REPORT

A 51-year-old man with a history of hypertension, hyperlipidemia, type A aortic dissection status post ascending aorta replacement in 2007 and type B aortic dissection with resulting aneurysmal degeneration of the thoracic aorta status post thoracic endovascular aneurysm repair (TEVAR) in 2016 presented with left-sided neck swelling for 2 weeks. His arch replacement in 2007 involved ascending aorta-innominate artery and ascending aorta-left common carotid artery bypasses. His TEVAR in 2016 involved a carotid-subclavian artery bypass and the transposition of an aberrant vertebral artery from the aortic arch to the left common carotid artery distal to the subclavian bypass (Fig 1). Although neither vertebral artery was thought to be dominant at the time, the transposition was performed to preserve spinal cord perfusion during the TEVAR while simultaneously decreasing the risk of post-TEVAR endoleak. His physical examination was significant for a painless pulsatile left cervical neck mass; no neurologic deficits were noted. He had a white blood cell count within normal limits and negative blood cultures.

A computed tomography scan of the neck and chest demonstrated a 6.7-cm pseudoaneurysm arising from the left vertebral-carotid anastomosis, with an accompanying shifting to the right and narrowing of the trachea (Fig 2). The right common carotid and vertebral arteries were patent. Furthermore, the bypasses from the arch replacement and TEVAR procedures were patent, although the internal mesenteric artery was noted to originate from the false lumen of the residual dissection; furthermore, a 3.9-cm abdominal aortic aneurysm was noted. Given his multiple previous surgeries, our patient was keen on an endovascular approach and, with his arch anatomy, a transradial approach was deemed most advantageous; his left radial artery measured 4.0 mm on duplex ultrasound examination. After patency of the ulnopalmar arch was confirmed with a Barbeau test, ultrasound-guided left radial artery access was obtained. He was given 3000 U of heparin, 200 μg of nitroglycerin, and 2.5 mg of verapamil through a 6F Glidesheath (Terumo, Somerset, NJ). The patient was then systemically anticoagulated to an activated clotting time goal of 250 to 300 seconds. Subsequently, a 5F glide catheter was advanced over a Glidewire (Terumo) through the carotid-subclavian bypass into the external carotid artery. A 7F Ansel hydrophilic sheath (Cook, Bloomington, Ind) was then advanced into the common carotid artery, after which a 3- × 5-mm TransForm balloon catheter was used to occlude the vertebral artery. After 5 minutes of occlusion, the patient did not experience any neurologic deficits, and thus a glide catheter was used to deploy a 6.5- × 12-mm MicroVascular Plug (Medtronic, Minneapolis, Minn) along the transverse segment of the vertebral artery. Finally, an 8-mm × 2.5-cm Viabahn stent graft (W. L. Gore & Associates, Flagstaff, Ariz) was deployed in the common carotid artery to cover the origin of the vertebral-carotid anastomosis (Fig 1). Postdilation was performed with an 8-mm × 20-mm EverCross balloon (Medtronic), and completion angiograms demonstrated complete exclusion of the pseudoaneurysm (Fig 3).

The patient tolerated the procedure well, and he was discharged on lifelong aspirin and clopidogrel. Follow-up duplex ultrasound examination at 2 weeks postoperatively showed complete thrombosis of the pseudoaneurysm and over the

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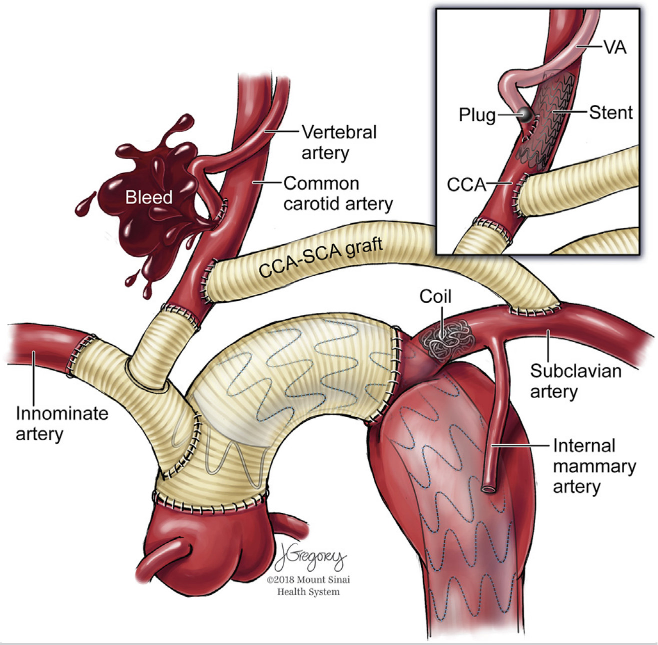

Fig 1. Arch anatomy. Previous procedures include an arch replacement involving the ascending aorta-innominate artery and ascending aorta-left common carotid artery (*CCA*) bypasses, in addition to a thoracic endovascular aneurysm repair (TEVAR) involving a carotid-subclavian artery (*SCA*) bypass and the transposition of an aberrant vertebral artery (*VA*) from the aortic arch to the left common carotid artery distal to the subclavian bypass. **Inset,** Transradial deployment of the plug and subsequently the covered stent to treat the pseudoaneurysm. (Copyright Mount Sinai Health System. All rights reserved. Reproduced with permission.)

next 3 months the neck hematoma resolved; there was no incidence of postoperative complications such as neurologic deficits or embolic events. He has remained asymptomatic at the 3- and 6-month follow-up visits.

DISCUSSION

Extracranial carotid aneurysms and pseudoaneurysms are rare, making up less than 1% of all aneurysms.[2] As a result, the largest contemporary series are comprised mainly of open surgical repairs[1,3,4]; data on endovascular techniques have been limited to case series.[5,6] Reports on transradial strategies for carotid pseudoaneurysms are even less common, given that the transfemoral approach is the conventional access site for carotid stenting.[7]

Despite the lack of evidence for endovascular treatment of carotid pseudoaneurysms, outcomes for carotid artery stenting in carotid stenosis may be applicable to carotid pseudoaneurysms if analyzed judiciously. For example, as it is for EVAR in abdominal aortic aneurysm repair, carotid artery stenting can be preferential in patients for carotid aneurysm repair depending on their comorbidities and anatomic constraints.[8-10] The etiology of the aneurysm should also be considered; mycotic

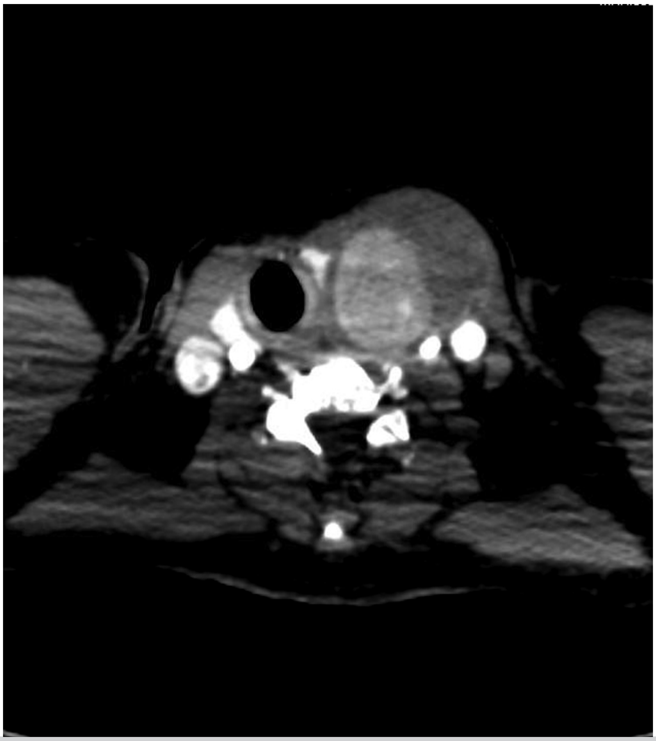

Fig 2. Axial neck computed tomography angiogram showing a 6.7-cm left common carotid anastomotic aneurysm. The contralateral carotid and vertebral arteries are patent.

aneurysms are typically not treated endovascularly unless performed as a temporizing measure.[11] In our patient, one factor in favor of endovascular intervention was his relatively young age affording him a decreased risk of stroke compared to CEA.[12,13]

Transradial access was pioneered for coronary interventions in 1989 and further tested for cerebral angiography in the late 1990s.[14,15] With promising early results, radial access subsequently took over as the primary means of coronary intervention.[16] This paradigm shift was supported by the results of the RIVAL and RIFLE trials, which showed that, in patients undergoing coronary angiography, radial access had the advantage of decreased rates of hematoma and pseudoaneurysm formation.[17,18]

In contrast, several factors have hindered uptake in the vascular surgery community. First, with radial arteries being significantly smaller than femoral arteries, operators are generally limited to 6F sheaths, with which certain devices may be incompatible.[19] Second, given the considerable distance to traverse, there are limited devices capable of reaching the lower extremities from the radial arteries while maintaining pushability and trackability.[20,21] Finally, radial access has several relative contraindications relevant for vascular patients. For instance, given the possibility of radial artery occlusion, some may hesitate to attempt radial access in patients who require dialysis access.[22,23] Still, technical

Fig 3. Completion angiogram demonstrating successful transradial deployment of the covered stent and complete exclusion of the carotid pseudoaneurysm.

advancements with new slimmer sheaths and longer catheters and wires have resulted in a renewed interest in radial access and, based on studies in current literature, the advantages seen in coronary and cerebral interventions can indeed be carried over to peripheral vascular procedures.[20,24] Of note, brachial artery access has also been previously investigated, but found to confer no advantage in terms of outcomes over femoral access.[25] Specifically regarding carotid interventions, transcarotid artery revascularization is being increasingly adopted for carotid stenosis treatment. Benefits compared with radial access include stroke risk reduction via flow reversal as well as the avoidance of aortic arch manipulation, which have to be weighed against requiring open surgical exposure of the proximal common carotid artery.[26]

Our patient had multiple characteristics that made the left radial artery the preferable means of access. Although the majority of left carotid stenoses have been previously treated from the right radial artery (which offers a more favorable angle to cannulate the left common carotid artery), his history of aortic reconstruction and prior TEVAR rendered the aortic arch challenging to cross.[7,27] In addition, given the residual dissection in his descending aorta, femoral access would have risked entering the false lumen and extending the plane of dissection. His existing carotid-subclavian bypass provided a direct path to the pseudoaneurysm while avoiding any aortic manipulation. Finally, his radial artery was of adequate size to accommodate even a 7F sheath; sheath size is positively correlated with adverse outcomes such as radial artery occlusion.[28]

Endovascular repair of carotid pseudoaneurysms has taken the form of three treatments over the last decade: covered stenting, bare metal stenting, and bare metal stenting with adjunctive coiling.[1,29] All three have had success with treating carotid pseudoaneurysms, although Li et al[6] reported in a systemic review that covered stenting resulted in a higher rate of aneurysm sac thrombosis and lower rates of reintervention. Owing to the anastomotic etiology as well as the existing size of the pseudoaneurysm, a covered stent was ultimately chosen to expeditiously minimize the risk of rupture.

The ideal follow-up imaging protocol for carotid pseudoaneurysm stenting has yet to be elucidated; previous reports have proposed that Doppler ultrasound examination is an inexpensive and reliable modality to determine stent patency and that patients should be seen postoperatively at 30 days, 3 months, 6 months, and annually thereafter.[5,30,31] Given the successful intraoperative exclusion of the pseudoaneurysm and clinical improvement observed at 3 and 6 months, we anticipate continued positive results at our patient's future follow-up visits.

CONCLUSIONS

Given the appropriate anatomy, successful transradial treatment of carotid pseudoaneurysms can be achieved.

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