Endovascular repair of symptomatic carotid artery aneurysm with covered stent: A case report and literature review

Alireza Hamidian Jahromi, Tze-Woei Tan, Amy H Coulter, Linda D Doucet and Wayne W Zhang

Abstract

Objectives: Extracranial carotid artery true aneurysm is extremely uncommon, and definite treatment has traditionally involved open surgical repair. Although successful management of the internal carotid artery aneurysms using endovascular stenting and embolization has recently been reported, only a limited number of cases have been reported.

Methods: We present a case of symptomatic carotid true aneurysm repaired with covered stent and coil embolization of the external carotid artery. We also review the English literature and discuss the epidemiology, causes, diagnosis, and management options of internal carotid artery aneurysms.

Results: The patient did not have any complications, and was discharged home on the postoperative day 1 in stable condition.

Conclusion: Our report suggests that endovascular procedure is feasible in the treatment of extracranial carotid artery aneurysms.

Keywords

Endovascular surgery, covered stent, internal carotid artery aneurysm

Date received: 20 October 2014; accepted: 10 January 2015

Case report

A 53-year-old African American male with a recent history of ischemic stroke and residual right side hemiparesis was found to have a 23 mm × 23 mm aneurysm involving the left distal common carotid and proximal internal carotid arteries by Duplex ultrasound. The aneurysmal segment was 35 mm in length. Computerized tomography angiogram (CTA) showed a large amount of thrombus inside the aneurysm sac (Figure 1). Endovascular repair of the left common and ICA aneurysm with a 6 mm × 100 mm Viabahn covered stent (W. L. Gore & Associates Inc., Flagstaff, AZ) and coil embolization of the left ECA were performed (Figure 2). The patient also had a right carotid artery aneurysmal dilatation with proximal ICA 15 mm in diameter. Since his right carotid aneurysm was asymptomatic with no thrombus, we decided not to intervene, but continue to follow the right carotid arteries with periodical imaging studies. The patient has consented to the publication of this article. Our institution does not require ethics approval for reporting individual cases.
Description of procedure
Arterial access was achieved through the right common femoral artery. The left CCA was cannulated using 0.035 Glide wire and a 5 Fr JV 1 catheter. A selective angiogram of the left CCA demonstrated an aneurysmal dilatation of the distal common and proximal internal carotid arteries. There was no intracranial aneurysm or stenosis of the cerebral arteries. At this point, 7000 units of unfractionated heparin were administered intravenously. The 0.035 Glide wire was then inserted and placed into a branch of the left ECA. The JV 1 catheter was advanced over the wire into the ECA.

The Glide wire was then switched to a 0.035 super stiff Amplatz wire (Boston Scientific Corp., Marlborough, MA). An 8 Fr 90-cm introducer sheath was then inserted over the Amplatz wire into the left CCA. A 5 Fr angled guiding catheter was positioned in the proximal ECA over the wire. When the access was secured, embolization of the ECA was performed using two 4 mm × 80 mm Interlock coils (Boston Scientific Corp.).

A 3.5 mm × 3.5 mm filter-wire EZ embolic protection device (Boston Scientific Corp.) was introduced through the 8 Fr sheath and placed into the ICA above the carotid aneurysm. Based on the angiographic measurements, a 6 mm × 100 mm Viabahn covered stent was deployed under fluoroscopy. Post-deployment completion angiogram demonstrated that the stent was in a good position with no evidence of endoleak, kink, or stenosis.

The puncture site of the right common femoral artery was closed using an 8 Fr Angio-Seal closure device (St. Jude Medical, Inc., St Paul, MN). The patient did not have any complications postoperatively. He was discharged home on the postoperative day 1 with daily aspirin (81 mg) and Plavix (75 mg). Carotid Duplex ultrasound 2 weeks after the procedure showed that the stent was widely patent and the aneurysm was completely excluded. At the follow-up of 1 and 2 years after the procedure, the patient did not have any problem related to the carotid artery aneurysms. CTA demonstrated that the stent was patent without endoleak or stenosis (Figure 3).

Discussion
Extracranial carotid artery aneurysm accounts for only 0.4% of all peripheral artery aneurysms. Extracranial ICA aneurysm is even rarer, but it may cause cerebral embolization, local compression of the neurovascular structures and carotid aneurysm rupture, stroke, and even death. Failure of corrective surgical procedures or possible intra- or postoperative complications could also be extremely debilitating.

Aneurysm size, etiology, location and anatomic relation to surrounding structures, presence of symptoms, and comorbidities of the patient are the factors being considered when choosing the treatment approaches for the management of carotid aneurysms.

The open surgery includes aneurysm resection and repair using interposition grafts or a patch angioplasty. Simple resection and end-to-end anastomosis may also be performed for the aneurysms with focal involvement. Although open repair has lower morbidity and mortality rates compared to direct carotid artery aneurysm ligation (9% risk of mortality and major stroke with open surgical repair versus 20% risk...
of mortality and 25% stroke rate following simple carotid artery ligation), it is still far from being an ideal approach.\textsuperscript{9} Open surgery is also associated with a high rate of cranial nerve injuries, especially when an aneurysm pushes the nerves away from their normal anatomic courses. As a matter of fact, the most frequently encountered neurological complications in open surgery of carotid artery aneurysms are cranial nerve injuries. According to the literature, nerve injury occurs transiently in 11\%–22\% of the cases and permanently in 3\%–13\% of the patients.\textsuperscript{10} Performing an open surgery is very challenging in patients with previous neck irradiation and/or surgery or when the aneurysm is very close to the skull base, in which distal ICA control may not be feasible. In contrast to open procedures, endovascular approach can be performed under local anesthesia, and there is no need of proximal and distal carotid artery control. Cranial nerve injury can, therefore, be avoided.

Li and colleagues assessed all of the reported cases in the English literature who underwent stenting for the management of extracranial carotid artery aneurysms between 1995 and 2010. The study included the cases with true aneurysms as well as pseudoaneurysms in the CCA, ICA, and external carotid arteries. Only five of the cases had true carotid aneurysm. Stent graft patency was reported to be 93\%.\textsuperscript{9} Zhou et al.\textsuperscript{11} reported 42 cases with a mixture of true, false, and post-traumatic aneurysms involving extracranial ICA and CCA. The authors did not specify the type, cause, exact aneurysmal location, and extent of involvement in
individual patient. Their retrospective chart review reported endovascular interventions in 14 cases (7 cases using stent graft exclusion, 6 cases with bare stent and colis embolization, and 1 case with endovascular embolization). However, the authors did not mention whether the aneurysms were true or false in individual cases. We were unable to include their experience when discussing the endovascular management of the cases with true ICA or CCA aneurysms reported in the literature.

According to the classification described by Attigah et al.,10 the current case was a Type III carotid artery aneurysm. Traditionally, the surgical management in such cases has been excision or resection of the segment along with reconstruction by aneurysmorrhaphy, patch angioplasty, or graft interposition.10

We would like to emphasize that open aneurysm repair is more reliable in terms of durability. Endovascular approach can be used in the patients who have high risks for open surgery due to systemic or regional comorbidities.

In this case, as the aneurysm was involving both the proximal ICA and distal CCA with a long (35 mm) and tortuous segmental dilatation, we were concerned that the stiffness of a balloon-expandable covered stent might result in kinks of the carotid arteries at the points immediately proximal and distal to the ends of the stent. Therefore, a flexible self-expanded Viabahn covered stent was employed.

Stent fracture is a worrisome issue following endovascular approach in highly mobile regions. In cases similar to our case, such risk still exists even if a flexible Viabahn covered stent will be chosen. Given the severe neurological consequence in situations where stent occlusion occurs, periodical follow-up with Duplex ultrasound (every 6 months) and lifetime anti-platelet (Clopidogrel) is recommended.

In summary, endovascular repair as a management of carotid artery aneurysms is feasible and can be performed safely in selected patients, although the long-term outcome needs to be assessed.

Acknowledgements
The authors would like to thank Mr John Cyrus who provided us editorial assistance. This case was presented at the 2014 Joint Annual Meeting of the New England Society for Vascular Surgery and the Eastern Vascular Society, 11–14 September 2014, Boston, MA. The patient has consented to the publication of this article.

Declaration of conflicting interests
None of the authors have any conflict of interest to disclose.

Funding
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References
1. Fankhauser GT, Stone WM, Fowl RJ, et al. Surgical and medical management of extracranial carotid artery aneurysms. J Vasc Surg Epub ahead of print 20 August 2014. DOI: 10.1016/j.jvs.2014.07.092.
2. Macina AS, Vidjak V, Erdelez L, et al. Open surgical and endovascular treatment of extracranial internal carotid artery aneurysms. Perspect Vasc Surg Endovasc Ther 2009; 21(3): 181–185.
3. Juszkat R, Wróbel M, Golusiński W, et al. Stent-graft treatment of extracranial internal carotid artery aneurysm. Eur Arch Otorhinolaryngol 2005; 262(10): 826–829.
4. Chan AW, Yadav JS, Krieger D, et al. Endovascular repair of carotid artery aneurysm with Jostent covered stent: initial experience and one-year result. Catheter Cardiovasc Interv 2004; 63(1): 15–20.
5. Ruebben A, Merlo M, Verri A, et al. Exclusion of an internal carotid aneurysm by a covered stent. J Cardiovasc Surg 1997; 38(3): 301–303.
6. Ghazi P, Haji-Zeinali AM and Zarghampour M. Staged endovascular treatment of left common carotid artery large aneurysm with Gore-Hemobahn stent-graft after right common carotid artery stenosis angioplasty. J Invasive Cardiol 2010; 22(7): E129–E131.
7. Cil BE, Ucar I, Ozsoy F, et al. Successful endovascular treatment of a left common carotid artery aneurysm following failed surgery of a right common carotid artery aneurysm. Cardiovasc Intervent Radiol 2005; 28(3): 367–371.
8. Ohshima T, Miyachi S, Hattori K, et al. A case of giant common carotid artery aneurysm associated with vascular Behçet disease: successfully treated with a covered stent. Surg Neurol 2008; 69(3): 297–301.
9. Li Z, Chang G, Yao C, et al. Endovascular stenting of extracranial carotid artery aneurysm: a systematic review. Eur J Vasc Endovasc Surg 2011; 42(4): 419–426.
10. Attigah N, Kükens S, Zausig N, et al. Surgical therapy of extracranial carotid artery aneurysms: long-term results over a 24-year period. Eur J Vasc Endovasc Surg 2009; 37(2): 127–133.
11. Zhou W, Lin PH, Bush RL, et al. Carotid artery aneurysm: evolution of management over two decades. J Vasc Surg 2006; 43(3): 493–496.