Hybrid (Open and Endovascular) Repair of Distal Extra-cranial Internal Carotid Artery Aneurysm

E. Wong, W.-L. Chue

Vascular Surgery Unit, Frankston Hospital, Peninsula Health, Victoria, Australia
Beleura Private Hospital, Mornington, Victoria, Australia

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Abstract
This paper describes a hybrid repair of a distal extra-cranial internal carotid artery aneurysm involving open surgical transposition of the internal carotid artery followed by endovascular stent graft repair of the aneurysm. This procedure is most useful in cases with challenging anatomy to enable repair of the internal carotid artery aneurysm with minimal morbidity to the patient.

Introduction

Hybrid procedures (combined open and endovascular techniques) are becoming increasingly common in Vascular Surgery. This paper describes a hybrid repair of a distal extra-cranial internal carotid artery (ICA) aneurysm involving open surgical transposition of the internal carotid artery followed by endovascular stent graft repair of the aneurysm.

Report

A 79-year-old lady presented with dysphagia and a pulsatile mass in the right tonsillar fossa. CT scan demonstrated a 3.3 cm distal right ICA aneurysm, above the level of the mandibular rami. There was no thrombus within the aneurysm. The proximal ICA was tortuous and redundant.

Surgical technique

Internal carotid artery transposition
The operation was performed in the angiosuite. Under general anaesthesia, the right common carotid (CCA), external carotid (ECA) and proximal internal carotid arteries were dissected and controlled via an incision anterior to the sternocleidomastoid muscle. Due to the retromandibular location of the aneurysm, the dissection of the internal carotid artery was difficult. With the patient systemically heparinised, we performed trial clamping of the internal carotid artery whilst monitoring the patient’s vital signs. In the event that a shunt was required, the plan was to perform the arterial anastomosis with an argyle shunt in situ. The ICA was transected at its origin and its...
stump oversewn with 4/0 Surgipro (Covidien Syneture). The ICA origin was then transposed onto the proximal CCA and anastomosed in an end to side fashion to straighten the vessel (Fig. 1).

Stent graft repair of right internal carotid artery aneurysm
An arterial puncture was then made in the CCA opposite the origin of the transposed ICA and a 7 French sheath introduced. The distal ICA was selectively cannulated using an 0.035 inch glidewire (Terumo Medical Corp) and a Vanschie 2 catheter (Cook Medical). The wire was exchanged to a Rosen wire (Cook Medical) for increased stability. A 5 mm Viabahn (W. L. Gore & Associates, Inc) graft was positioned across the aneurysm neck and deployed. Completion angiogram demonstrated satisfactory sealing of the aneurysm with no evidence of endoleak. The intraoral pulsatility of the aneurysm was dramatically reduced (Fig. 2).

Follow up
The patient was prescribed clopidogrel for a period of 12 months followed by lifelong aspirin. A CT scan performed 1 week after surgery demonstrated no evidence of endoleak nor kinking of the stent graft. The patient was further reviewed at 3 months with an ultrasound which demonstrated a patent stent graft with no endoleak.

Discussion
Standard carotid artery aneurysms repair involves an open approach with aneurysmorrhaphy or a surgical bypass of the aneurysm. Aneurysms located in the distal ICA present a significant challenge for surgical exposure of the carotid artery beyond the aneurysm for distal control. In these cases, exposure of the distal ICA may necessitate naso-

Figure 1  Preoperative CT angiogram demonstrating a distal right internal carotid artery aneurysm with a tortuous proximal internal carotid artery. Intra-operative angiogram after transposition of the internal carotid artery, with correction of the tortuosity.

Figure 2  Completion angiogram and CT angiogram (performed 1 week after surgery) demonstrated successful exclusion of the internal carotid artery aneurysm with no evidence of endoleak.
pharyngeal intubation, the division of the digastric muscle and the sternocleidomastoid branch of the occipital artery, division of the styloid process and the muscles originating from it, as well as possible dislocation of the temporo-mandibular joint or even a mandibulotomy. These steps can be technically challenging and is associated with high morbidity (especially cranial nerve injury).1

Endovascular treatment of ICA aneurysms has been described. The techniques reported include stent graft repair and exclusion of the aneurysm, and aneurysm coil embolisation.2 Stent graft repair is usually performed via a femoral access route with placement of the covered stent extending from the normal proximal ICA to the distal vessel beyond the aneurysm. The presence of extensive tortuosity of the ICA and complex aortic arch types can make device access challenging. The risk of post deployment graft thrombosis is also likely to increase in a tortuous vessel. Procedures performed via femoral access necessitate the use of long length guidewires, catheters and sheaths which could reduce the degree of device control available to the operator. It also requires passage of guidewires, catheters and sheaths through the aortic arch which can be associated with increased risk of cerebro-vascular events especially in diseased, calcified vessels.3

This patient has an extra-cranial ICA aneurysm that is anatomically challenging if repaired with either open or endovascular surgical technique in isolation. The distal location of the aneurysm and the extensive tortuosities of the proximal ICA were noted during the treatment planning process. The hybrid technique described in this paper provided open access to the carotid vessels and transposition of the ICA to correct the ICA tortuosity. Controlled passage and deployment of the stent graft for repair of the distal ICA aneurysm could then be achieved safely without the need for challenging open exposure of the distal ICA.

Conclusion

This paper describes a hybrid technique for repair of a distal extra-cranial ICA aneurysm with challenging anatomy. Most carotid artery aneurysm repairs reported in the literature involved aneurysms located in the proximal portion of the ICA which would not require a hybrid approach. A hybrid procedure is most useful in cases with challenging anatomy to enable repair of the ICA aneurysm with minimal morbidity to the patient.

Conflict of interest/funding

None.

References