Case Report

Transvenous embolization of a direct carotid-cavernous fistula through the pterygoid plexus approach

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Abstract

We present a transvenous embolization technique for a direct carotid-cavernous fistula through the pterygoid plexus to the cavernous sinus which only 2 cases have been previously reported in the English literature. This method is appropriate when transarterial techniques or other attempts at transvenous access have failed due to vessel tortuosity, hypoplasia, stenosis, or occlusion.

A middle-aged female patient presented with progressive left exophthalmos with conjunctiva chemosis and bruit after sustaining a falling injury. Digital subtraction angiography revealed Barrow type A carotid-cavernous fistula. The drainage route passed through a distal thrombosed superior ophthalmic vein that ended deep in the orbit. No other patent venous sinuses connected to the cavernous sinus, except for a small tract of pterygoid plexus. After failure of transarterial approach and other methods of transvenous access, we attempted to superselectively access to the cavernous sinus by applying transpterygoid technique with embolization using detachable coils. The transpterygoid venous approach to accessing the cavernous sinus represents an alternative approach when other techniques fail.

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Background

An arteriovenous fistula of cavernous sinus is comprised of an abnormal connection between internal carotid artery (ICA) or external carotid artery (ECA) and cavernous sinus (CS). Carotid-cavernous fistulas (CCFs) can be classified as direct (feeders from the main trunk of ICA) or indirect (feeders from the dural branches of ICA, ECA, or both) and are usually divided into 4 subtypes according to the Barrow classification [1]. Type A represents direct connection between the ICA and CS, whereas types B, C, and D are indirect fistulas and considered cavernous sinus dural arteriovenous fistulas (CSDAVF). Type B fistulas are located between meningeal branches of the ICA and CS. Type C fistulas are located...
between meningeal branches of the ECA and CS. Type D fistulas involve abnormal communication between the CS and meningeal branches of both ICA and ECA. These abnormal connections to the CS cause venous hypertension, which may result in venous congestive symptoms, cranial nerve compromise, perfusion reduction, and haemorrhage [2]. Endovascular embolization through arterial or venous approach is considered first-line treatment for CCFs. Transvenous embolization is usually performed through the inferior petrosal sinus (IPS) or superior ophthalmic vein (SOV). If transvenous access to the CS is not possible, approaches from other CS connections may be used. Transvenous embolization through the pterygoid plexus has been previously described twice: in one case, a CSDAVF was embolized through contralateral pterygoid plexus [3]; in the other, a direct CCF was treated through ipsilateral pterygoid plexus [4]. Here, we describe the successful ipsilateral transpterygoid plexus embolization of direct CCF after transarterial catheterization failed and no opacification of the IPS and SOV was present.

Case presentation

A middle-aged female presented with 2-month history of progressive left exophthalmos with chemosis after a fall. An orbital bruit was auscultated. Neurological examination indicated normal consciousness without cranial nerve deficits. Computed tomography angiography and magnetic resonance imaging showed left middle cranial fossa subdural hematoma and a prominent left CS with left SOV engorgement. Digital subtraction angiography showed direct left CCF originating from the inferior aspect of posterior horizontal C4 segment in the cavernous ICA (Fig. 1A) with venous drainage from the CS into SOV and pterygoid plexus. The IPS did not opacify and thrombosis of the left distal SOV without connection to the facial vein was observed (Fig. 1B).

Both femoral artery and vein punctures were performed. An ENVOY 6-Fr guiding catheter (Codman Neuro, Raynham, MA) was positioned in the left cervical ICA and a coaxial Excelsior microcatheter (Stryker Neurovascular, Fremont, CA) passed into the posterior genu of the ICA (C4 segment). Another 5-Fr guiding catheter was placed in the left internal jugular vein. Navigation of microcatheter into the fistula failed because of an acutely angulated posterior genu and small fistula ostium. Scepter balloon (Microvention, Tustin, CA) assisted microcatheter navigation was then attempted. The tip of microcatheter was positioned at the ostium but could not enter CS (Fig. 2A). We then attempted to pass the venous guiding catheter into the nonvisible IPS coaxially with a 0.035-inch guidewire, which also failed. Careful evaluation of multiphases of the angiogram revealed a transforaminal channel passing from the CS to the pterygoid plexus. An Excelsior microcatheter was manipulated over a 0.014 guidewire through the guiding catheter located in the external jugular vein and advanced through the left retromandibular vein, maxillary vein, and pterygoid plexus into the CS (Fig. 2B). A total of 6 Target Detachable Coils (Stryker Neurovascular) were used to perform coil embolization.

Postembolization angiography showed complete CCF occlusion (Fig. 3). No procedure-related complications occurred. The patient’s chemosis and exophthalmos resolved completely 3 days after embolization and she remained neurologically intact.

Discussion

Endovascular embolization is the treatment of choice for CCF. Approaches include transarterial catheterization of feeders or fistula ostium [5] and transvenous access, which is most often achieved through IPS or SOV [6]. Transarterial embolization
Conclusion

The transpterygoid plexus approach can provide alternative access to the CS for embolization if transarterial catheterization is not feasible or transvenous approach through the IPS and SOV fails.

Declarations

Ethics approval and consent to participate

According hospital’s ethical policy for case reports, this study had received the patient consent form agreement.

Consent for publication

This study had received the publication consent form agreement.

Availability of data and material

All relevant data is provided in the manuscript. However, additional supplementary data can be provided from the corresponding author upon request.

Author’s contribution

Conception and design: CHO, WCL. Acquisition of data: CLL, PLL, CHO. Analysis and interpretation of data: CHO, WCL, TYC. Drafting the article: WCL, CHO. Critically revising the article: CHO, TYC. Technical/device/material support: PLL, CLL. Study supervision: CHO. All authors read and approved the final manuscript.

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