Transvenous Embolization of a Carotid Cavernous Fistula Complicated by a Hematoma at the Tentorial Edge

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Summary

Indirect (dural) carotid cavernous fistulae are generally treated by endovascular surgery primary transvenous embolization that is safe and effective. We describe here a case of a left indirect carotid cavernous fistula that presented with proptosis and eye redness. The patient underwent transvenous embolization of carotid cavernous sinus. The procedure was complicated by a haemorrhage from the cavernous sinus. The post procedural CT scan showed a haematoma at the tentorial edge. Precise diagnosis and prompt treatment could prevent severe complications.

Introduction

Indirect carotid cavernous fistula consists of arteriovenous shunting within the dura between the carotid artery and the cavernous sinus. Transvenous embolization of the cavernous sinus is a safe and effective treatment for this type of fistula. Here we describe a case of a left indirect carotid-cavernous fistula that was treated by transvenous embolization for which the operation was complicated by a haemorrhage from the cavernous sinus at the tentorial edge.

Case Report

A 26-year-old woman presented with a six-month history of left eye proptosis and eye redness. The intraocular pressure of the left eye

was 25 mmHg. Brain MRI showed an engorged left superior ophthalmic vein, suggesting carotid cavernous fistula. The cerebral digital angiogram revealed an indirect dural carotid cavernous fistula, with multiple feeders from both the left internal carotid artery (ICA) and left external carotid artery (ECA), classified as type D according to Barrow et al.'s classification¹. The drainage of the left cavernous sinus was retrograde through the left superior ophthalmic vein.

Under general anaesthesia and heparinization, the procedure was performed by the left internal jugular vein approach, allowing the catheterization of the left inferior petrosal sinus. The cavernous sinus was reached with a microcatheter (Echelon 14, EV3) allowing the deployment of 14 platinum coils (GDC, Stryker) in the left cavernous sinus. After the delivery of the eighth coil, the patient experienced bradycardia and slight hypertension. The immediate control angiogram showed the extravasation of contrast material from the cavernous sinus (Figure 1) posteriorly. Heparin was immediately reversed by protamine sulphate and the coiling was continued until closure of the fistula. Within a few minutes the bradycardia and hypertension resolved and the angiogram confirmed the discontinuation of the contrast leak. After the procedure the patient was alert without any neurological deficit or headache.

The post-procedural CT scan showed an intracranial haematoma located at the tentorial edge (Figure 2). The patient was alert without any deficit at discharge.

Figure 1 Cerebral angiography showed the contrast leak (black arrow) from the cavernous sinus during coiling.

Figure 2 Post-procedure CT scan showing the interdural haematoma of the tentorium (black arrow).

Discussion

Indirect (dural) carotid cavernous fistulae (DCCF) are dural arteriovenous fistulae (AVF), a connection between branches of the ICA or ECA or both and the cavernous sinus². Different approaches have been used to manage DCCF. For patients with mild symptoms, observation or intermittent carotid jugular compression are recommended, leading to closure of the fistulae in about 30%³⁻⁵. Surgery is not advocated because of its complexity⁵. Transarterial embolization of DCCF is inadequate because the dural feeding arteries (ECA or ICA branches) are tortuous and extensive². In addition, these branches supply many cranial nerves and embolization through them could result in major cranial nerve deficits.

Transvenous embolization is a safe and effective method of treatment and has become the mainstay in management of DCCF⁶⁻¹⁰. About 5% of complications after transvenous embolization have been reported¹⁰. They included worsening diplopia¹¹⁻¹⁴, facial pain¹¹, transient visual loss¹⁵, retrograde arterial penetration of embolic agents¹⁶, embolic infarction¹⁵, posterior fossa haemorrhage and venous infarction⁴.

Herein, to our knowledge we reported the first case of transvenous embolization of dural CCF complicated by a haematoma at the ten-

torial edge. In our case, coiling of the cavernous sinus resulted in intracranial haemorrhage, located within the tentorial dura mater. The haematoma could be in the interdural or subdural space, but we cannot exactly confirm it by present imaging. The cavernous sinus is a penta or hexahedron-shaped space bounded by the layers of the dura mater^{17,18}. Posterosuperiorly the cavernous sinus ends at the tentorium¹⁷⁻¹⁹.

In our case, during coiling of the posterior-superior space of the cavernous sinus, a coil perforated the thin inner layer of its roof and separated the two layers of the tentorium in the posterior-superior part of the cavernous sinus. Then the high intrasinus pressure due to coiling or the persistent fistula resulted in more separation of the two layers of the tentorium, facilitating the extension of the haematoma within it. Alternatively, the coil could have perforated the roof of the cavernous sinus posteriorly, resulting in a small subdural extravasation of blood at the tentorial edge.

As recommended for any intracranial haemorrhage during endovascular surgery^{20,21}, heparin reversal with protamin and continuation of coiling ceased the bleeding. In addition, the use of fluid embolization with glue (N-butyl cyanoacrylate) or ethylene vinyl alcohol (Onyx) can seal the perforation and stop the extravasation of blood. As in this case, the

prognosis of a limited and noncompressive interdural haematoma is good. Severe complications could be prevented by rapid diagnosis of

haematoma following cavernous sinus coiling and prompt treatment, heparin reversal, and quick sinus packing.

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