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# Transvenous embolisation of a carotid-trigeminal cavernous fistula

## 以經皮栓塞手術治療頸三叉動脈海綿瘻管

A carotid cavernous fistula is an abnormal communication between the internal carotid artery and the cavernous sinus. Rarely, this communication is associated with a persistent primitive trigeminal artery, with or without a trigeminal artery aneurysm. We report a case of spontaneous carotid-trigeminal cavernous fistula in which the persistent trigeminal artery was shown only on vertebral artery injection. The absence of an associated trigeminal artery aneurysm allowed a transvenous approach for endovascular treatment with coils and complete obliteration of the cavernous fistula.

頸動脈海綿瘻管是內頸動脈和海綿竇之間的異常連接。在很罕有的情況下，這種連接會與一條持續性原始三叉動脈有關，且可能會出現三叉動脈瘤。本文報告一宗自發性頸三叉動脈海綿瘻管病例，病人的持續性三叉動脈只在脊柱動脈注射時才被發現。由於沒有出現三叉動脈瘤，因此可利用經皮方法施行血管內線圈植入手術，將海綿瘻管完全填塞。

### Introduction

A carotid cavernous fistula (CCF) is an abnormal communication between the carotid artery and the cavernous sinus. In the foetus, the primitive trigeminal artery has a direct communication with the internal carotid artery and the precursors of the basilar artery. On cerebral angiograms the trigeminal artery has been found to persist in adulthood in 0.1 to 0.6%<sup>1</sup> of the population and is known as the persistent trigeminal artery (PTA).

Enomoto et al<sup>2</sup> reported the first case of a PTA associated with CCF, in which the fistula resulted from rupture of an aneurysm arising at the junction of the right internal carotid artery and the PTA. In subsequent cases of carotid-trigeminal cavernous fistula, both the presence<sup>3,4</sup> and absence<sup>5-10</sup> of trigeminal artery aneurysms were represented. We report a case of spontaneous carotid-trigeminal cavernous fistula, successfully obliterated by endovascular treatment with coils, using a transvenous approach.

### Case report

A 50-year-old woman with good past health and no history of trauma, presented in June 2004 with a complaint of headache for 1 month. She then developed right eye pain and noted hearing 'heart sounds' on lying down. A physical examination revealed right eye chemosis, diplopia due to right sixth nerve palsy, a right temporal bruit, mild right proptosis, and elevation of right intraorbital pressure. Her visual acuity was impaired (right 20/50 vs left 20/70). Computed tomography revealed a dilated right superior ophthalmic vein. A right internal carotid arteriogram showed opacification of the right cavernous sinus in the arterial phase (Fig 1a). The right cavernous sinus was distended, with enlarged draining pathways involving the right superior ophthalmic vein and the right inferior petrosal sinus. No anomalous artery was detected on the right internal carotid artery injection. The right vertebral artery injection demonstrated an enlarged right PTA, however. Posterior to anterior flow from the basilar artery via the trigeminal artery, through the fistula into the dilated right cavernous sinus was shown (Fig 1b).

#### Key words:

Carotid-cavernous sinus fistula;  
 Embolization, therapeutic;  
 Trigeminal nerve

#### 關鍵詞：

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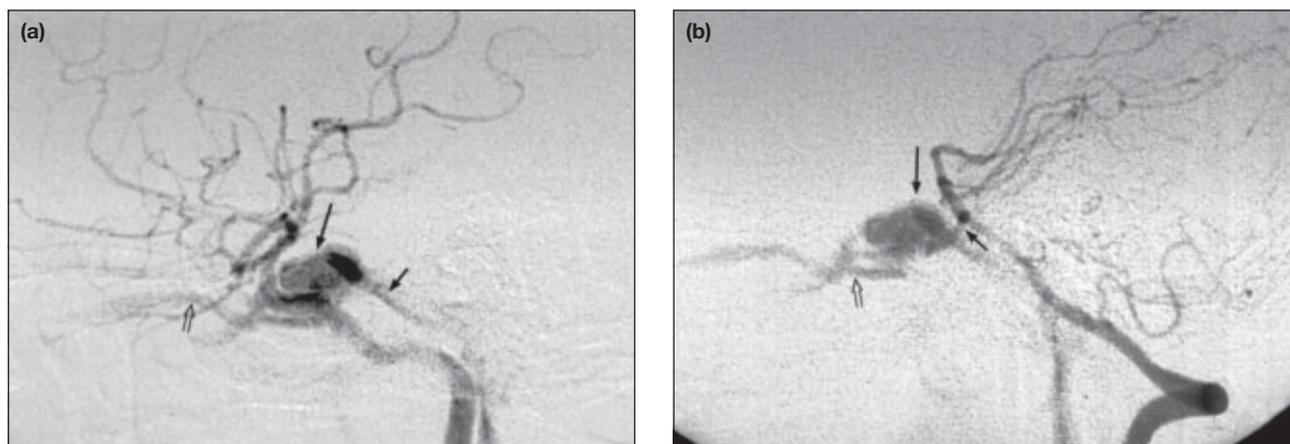
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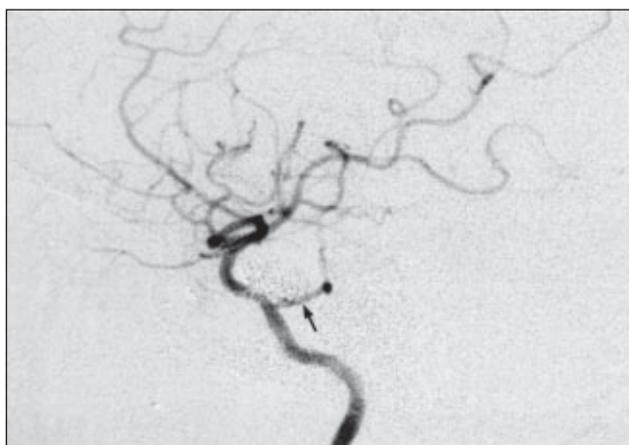
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**Fig 1. Pre-embolisation diagnostic angiographic study**

(a) Right internal carotid arteriogram showing opacification of the distended right cavernous sinus (long arrow) draining through the right superior ophthalmic vein (open arrow) and the right inferior petrosal sinus (arrow); and (b) right vertebral arteriogram demonstrating an enlarged right persistent trigeminal artery (arrow) with posterior to anterior flow through the dilated right cavernous sinus (long arrow) to the superior ophthalmic vein (open arrow)



**Fig 2. Post-embolisation angiographic study**

Right internal carotid angiogram showing anterior to posterior flow through the persistent trigeminal artery (arrow), with no opacification of the cavernous sinus

Under general anaesthesia, a 5-French (5F) catheter was positioned in the right internal carotid artery for diagnostic angiography and for delineating the venous pathways. A 6F guiding catheter was placed in the distal right internal jugular vein, and using a coaxial approach, a 2F microcatheter (Excelsior; Boston Scientific, Fremont, US) was navigated over a 0.36-mm microguidewire (Transend Ex floppy; Boston Scientific, Fremont, US) via the right inferior petrosal sinus to the right cavernous sinus. Transvenous embolisation of the origin of the superior ophthalmic vein and the right cavernous sinus with 17 electrolytically detachable coils with 4-mm to 8-mm diameters (Matrix 2D; Boston Scientific, Fremont, US) resulted in complete obliteration of the trigeminal cavernous fistula, as shown on both right vertebral and internal carotid artery injections. The post-embolisation right internal carotid angiogram

showed anterior to posterior flow through the PTA to the basilar artery (Fig 2). The post-embolisation right vertebral arteriogram demonstrated posterior to anterior flow through the PTA into the internal carotid artery, with no opacification of the cavernous sinus. No trigeminal artery aneurysm was demonstrated in the pre- or post-embolisation angiograms.

The patient was discharged on the fourth day after embolisation, with relief of her conjunctival injection and chemosis. Her diplopia had improved, with only occasional episodes of diplopia lasting a few seconds. Clinical follow-up 4 months postoperatively revealed only mild diplopia on extreme downward gaze, which was thought to be due to cyclovertical muscle dysfunction. There was no conjunctival injection evident, and no symptoms of headache, eye pain, or blurred vision.

## Discussion

The aim of treatment of CCF is to close the abnormal communication between the feeding artery/arteries and the cavernous sinus. Endovascular treatment of CCF has superseded open surgery. It is a safer and more efficacious method and can be performed via the transarterial<sup>11,12</sup> or the transvenous route. In recent years, embolisation via the venous route into the cavernous sinus has been advocated.<sup>13-15</sup> In selected cases it may be combined with transarterial embolisation.<sup>13</sup> The use of detachable coils allows precise occlusion of the fistula site, and comparably good results have been achieved.<sup>12-15</sup>

The presence of an aneurysm in the PTA may have a bearing on the treatment approach selected, as occlusion of the PTA and the aneurysm via a transarterial route may be necessary. Transvenous treatment can be definitive where there is no aneurysm present, as in the present case. Open

surgery is an alternative treatment of choice when endovascular expertise is not available, or when endovascular treatment fails. Open surgery has also been advocated for concurrent occlusion of the PTA in a carotid-trigeminal cavernous fistula without evidence of an aneurysm, due to the increased risk of infarction or haemorrhage in the vertebro-basilar artery territory associated with a PTA. However the enhanced risk of complications with open surgery is illustrated by the frequent sacrifice of the internal carotid artery.<sup>4</sup>

Coil embolisation of a carotid-trigeminal cavernous fistula via a combined transarterial and transvenous route was employed successfully by Bernstein et al.<sup>10</sup> Subsequently, Oka et al<sup>8</sup> described the transvenous embolisation of a CCF associated with a PTA. Despite an incomplete obliteration at the conclusion of the procedure, disappearance of the fistula, presumably due to accelerated thrombosis, was shown angiographically 2 weeks later.<sup>8</sup> The current case is the first reported case in which a complete obliteration of the carotid-trigeminal cavernous fistula was achieved immediately at the conclusion of transvenous embolisation with coils. The other illustrative point of note in this report is the necessity of including a vertebral artery injection in the standard angiographic investigation of a CCF, as the PTA component may not be shown on an internal carotid angiogram. Investigation for a PTA is important when planning treatment as the detection of an associated aneurysm may necessitate a combined transvenous and transarterial approach. It is also imperative for assessing the completeness of obliteration of the carotid-trigeminal cavernous fistula after embolisation.

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