

A review of the Carotid-cavernous fistula

Minas K Minas *, Ioannis Panormitis Dimitriadis and Stavroula Tampaki

Vascular surgery- General hospital of Rhodes-Greece.

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Abstract

The carotid-carvenous fistula is a specific type of arteriovenous connection at the cavernous sinus which causes series of serious ophthalmologic problems. In this article is described the symptoms, the treatment (open or endovascular) and the etiology of CCF. Also is mentioned to the types of CCF according with the blood flow and to the Barrow anatomical classification.

Keywords: Carotid-carvenous fistula; Cavernous sinus; Endovascular techniques

1. Introduction

The carotid – cavernous fistula is consider as a interconnection between the branches of the ophthalmic artery which is branch of the internal carotid and the venous system in the cavernous system. Most CCFs are not life threatening, but the involved eye is at risk.

2. Method

The purpose of this article is to provide a review of the clinical findings, diagnostic evaluation and treatment of CCF.

3. Background

The etiology of the carotid-cavernous fistula are 1) trauma 2) iatrogenic 3) vascular .

Hemodynamically the CCF classified as a high flow and as low flow.

The Barrow anatomical classification is the most commonly use (Michael G Nosko.2021). Distinguished as

- Type A fistulas are direct connections between the internal carotid artery (ICA) and the cavernous sinus
- Type B fistula results from dural branches of the ICA
- Type C results from dural branches from the external carotid artery (ECA)
- Type D result from dural branches from ICA and ECA

Epidemiological the most common cause is the trauma and injuries in a recent 70-75% and secondary is the rupture aneurysm, fibromuscular dysplasia and syndrome Ehlers- Danlos.

*Corresponding author: Minas K Minas

4. Symptoms

The clinical symptoms of the low flow CCF has least or no symptoms but in the high flow the symptoms are proptosis , ocular bruit, pulsatile **exophthalmos**, red eye, chemosis, visual disturbances, orbital pain and cranial nerve deficits.

5. Differential diagnosis of CCF

Some of the differential diagnoses for CCF include vascular lesions such as arteriovenous malformation and cavernous sinus thrombosis, cavernous sinus tumors, orbital tumors, skull base tumors and mucocele . (.Imtiaz A. Chaudhry, Sahar M. Elkhamry,2009)

5.1. Diagnosis

- CTA
- MRA
- Color Doppler
- Cerebral angiogram is the gold standard (DSA- digital subtraction angiography)
- Tonometry and pneumotonometry

5.2. Treatment

- Conservative treatment for the low flow CCF
 - Micro vascular- neurosurgical open approach
 - Endovascular treatment (best option)
 - Retreat automatically
 - Carotid-angular compression therapy (Pisit Preechawat,2008)
 - Stereotactic radiosurgery is reserved for cases of indirect CCFs that are not completely obliterated by embolization (Brian M Howard.2024)
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6. Endovascular treatment

A placement of a covered stent and coiling of the fistula from a transarterial route with stent assistance to preserve the internal carotid artery or transvenous approach using platinum coils.(Carotid-Cavernous Fistula –Michigan Medicine).

Endovascular treatment is preferred in the majority of cases except tentorial DAVF. The goal of embolization in cavernous direct AVF is the alleviation of symptoms, not angiographic cure. But transverse-sigmoid sinus direct AVF with venous restriction and leptomeningeal drainage should be treated aggressively. (Myoung Soo Kim .2002). To treat indirect CCFs, transvenous coil embolization is the safest and most effective technique. Liquid embolics are less effective and have more complications and should be carefully considered only in extenuating circumstances. (Matthew D Alexander,2019).

More recently, bare stent–assisted coil placement has proved to be another alternative particularly useful when arterial reconstruction is required, with no evidence of fistula recurrence and preservation of the parent artery at 3- to 6-month follow-up (F. Gomez,2007)

7. Open surgical treatment

- Can treated surgically by a craniotomy and using acrylate glue or clips to the vein
- Direct ligation with sutures and cross section of the A-V connection

7.1. Complications

Even with the spontaneous closure of a fistula, the patient may experience worsening symptoms due to cavernous sinus thrombosis. Complications related to endovascular embolization of CCFs are rare and include ophthalmoplegia, central retinal vein occlusion, ophthalmic artery occlusion, and cerebral infarction. Embolization through the SOV route may not be successful due to fragile or clotted veins which can cause complications such as vision loss.(Carotid Cavernous Fistula) Gurkirat S. 2023.

8. Conclusion

In summary, CCFs are a rare but treatable cause of orbital injury and vision loss (Luis Nicolas Gonzalez Castro, 2016). Endovascular embolization of CCFs with coiling or liquid agents is the treatment modality of choice. With appropriate treatment, progressive resolution of symptoms is expected in most patients.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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