CASE REPORT

Contralateral transvenous approach and embolization with 360° guglielmi detachable coils for the treatment of cavernous sinus dural fistula

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ABSTRACT

carotid-cavernous fistulas are spontaneous or acquired connections between the carotid artery and the cavernous sinus, being classified as direct or indirect; being usually diagnosed in postmenopausal women, but are also associated with other pathologies such as pregnancy, sinusitis and cavernous sinus thrombosis. They are clinically characterized by ophthalmological symptoms and pulsatile tinnitus. A 51-year-old woman who started her current condition about 4 years ago with pulsatile tinnitus, to which were added progressively: Pain, conjunctival erythema, right eye proptosis and the occasional headache of moderate intensity. Carotid-cavernous fistula was diagnosed, for the technical difficulty inherent in the case was made a contralateral transvenous approach and embolization with 360° GDG coils, with successful evolution of the patient. The endovascular management of these lesions is currently possible with excellent results.

Key words: Cavernous sinus, dural fistula, neurointerventional therapy

Introduction

The carotid-cavernous fistulas are spontaneous or acquired connections between the carotid artery and the cavernous sinus, being classified as direct or indirect. The first represents a direct connection between the internal carotid artery (ICA) and the cavernous sinus and may occur as a result of rupture of aneurysm or pseudoaneurysm of the intracavernous portion of the ICA, penetrating trauma, fibromuscular dysplasia, arterial dissection, or direct surgical trauma. We present an unusual case of a cavernous sinus dural fistula (CSDF) treated with a contralateral transvenous approach and embolization with 360° GDG coils.

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Case Report

A 51-year-old woman who started her current condition about 4 years ago with pulsatile tinnitus, to which were added progressively: Pain, conjunctival erythema, right eye (RE) proptosis and occasional headache of moderate intensity. Initially valued outside our institution where she was found with intraocular pressure (IOP) of 30 mm Hg RE. She was managed initially with ocular hypotensive drugs and referred to our institution.

On physical examination, we auscultated a murmur at right mastoid, temporal and malar levels. The neuro-ophthalmologic examination revealed right corneal hypoesthesia, hyperemia of conjunctival vessels in a Caput medusae fashion; tarsal vessels and RE eyelid margin congestion in a corkscrew-like vessels [Figure 1]. The ophthalmometry with a constant of 92 was 22 mm RE and 14 mm left eye (LE). IOP was 22 mm Hg RE and 14 mm Hg in the LE.

The ophthalmoscopy with pupillary dilation showed no abnormalities. From a neurological perspective, we not found further alterations. The magnetic resonance imaging showed infraorbital congestion with increased volume of the superior ophthalmic vein [Figure 2]. We noticed that both the proximal portion of the cavernous sinus and the intercavernous sinus were enlarged and with increased flow signal [Figure 2]. For

this reason, we suspect a left carotid cavernous fistula with right drainage, the reason of the only right-sided symptoms.

Cerebral panangiography was performed with digital subtraction using Seldinger technique in three-dimensional biplane angiography axiom artis (Siemens, Germany). Through selective catheterization of the ICA and the external carotid artery (ECA) was evidenced the presence of a dural fistula to the left cavernous sinus through dural branches of ICA cavernous segment [Figure 3] and the internal maxillary artery [Figure 4], with retrograde flow into contralateral cavernous sinus through intercavernous sinus, and thence to the superior ophthalmic vein, right pteriogoid plexus and inferior petrosal right sinus.

Due to the ocular hypertension and persistent and basic life limiting acufenus, endovascular treatment was decided. In angiography room, the patient was maintained with monitoring, analgesia and superficial sedation by neuroanesthesiologist. Under local anesthesia was performed puncturing to the femoral artery and vein to enter a short 7 Fr introducer in each one.

Catheterization of the left ECA was performed by a catheter JB2 of 5Fr (Terumo). For the venous way, right internal jugular vein was catheterized with a catheter guide 6-french ×90-cm (Envoy, Cordis, Miami Lakes, FL). By contrast injection through the left ACE and guided by road map, we perform supraselective catheterization of the left cavernous sinus with a microcatheter 1.9Fr ×150-cm (Excel, Boston Scientific, Fremont, CA) supported on a 0.014 inch microwire ×180-cm (Transend, Boston Scientific, Fremont, CA).

Therefore, to access this sinus we used the femoral vein, traveling through the internal jugular vein, inferior petrosal sinus and right cavernous sinus respectively, to access to the intercavernous sinus and posteriorly set the distal end of the microcatheter at the level of the left cavernous sinus [Figure 5]. We removed the microwire and proceeded to coil embolization of the left cavernous sinus.

14 Guglielmi detachable coil (GDC) 360° coils (Boston Scientific, Fremont, CA) were used. Final angiographic control showed complete occlusion of the fistula [Figure 5]. The procedure was completed without complications and introducers were removed. The patient went to hospitalization general ward, experiencing absence of the acufenus and craniofacial murmur. At 24 h after embolization, the patient was discharged with a considerable reduction in the erythema, conjunctival congestion and proptosis of RE [Figure 6 and 7]; and with IOP of 15.5 mm Hg, then was suspended ocular hypotensive administration.

Discussion

Cavernous sinus dural fistula usually occurs in postmenopausal women, but can occur in other age groups as a result of pregnancy, sinusitis or cavernous sinus thrombosis. It was determined that almost all occur spontaneously.[1-3]

There is no universal and compelling explanation regard to its origin, however, demonstrating that lateral and sigmoid sinus thrombosis precedes the formation of dural fistulas,[4] has motivated even, a significant number of authors to involve thrombosis of the cavernous sinus as CSDF precursor, leaving aside the previously proposed theory pointing to the microtrauma on the delicate vessels of the carotid siphon as a cause.[1]

The frankly traumatic etiology of CSDF is extremely rare, with only 11 cases reported to date.[2,5-7] The CSDF are characterized clinically by ophthalmological symptoms and pulsatile

Figure 1: It is shown the right proptosis and bipalpebral edema (a). It also can be observed the congestion of conjunctival vessels in a "caput medusae" and "corkscrew" fashion (b and c)

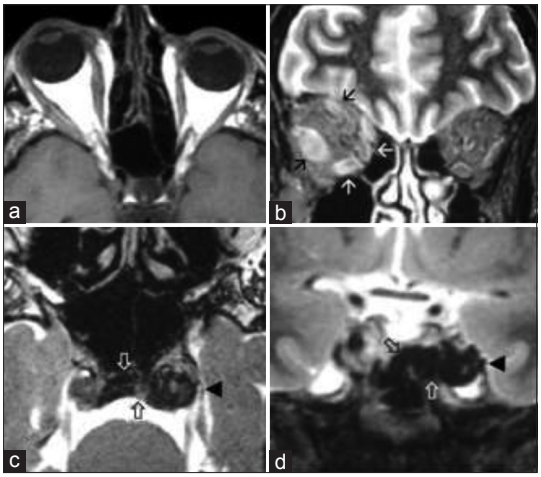

Figure 2: T2-weighted magnetic resonance imaging (MRI) shows the right eye propotosis (a), the ingurgitation of orbital veins and edema of the extraocular muscles (b, arrows). Note the dilatation and the absence of signal due to high-flow in the left cavernous sinus (c and d, arrowheads) and in the circular sinus toward the right cavernous sinus (c and d, hollow arrows)

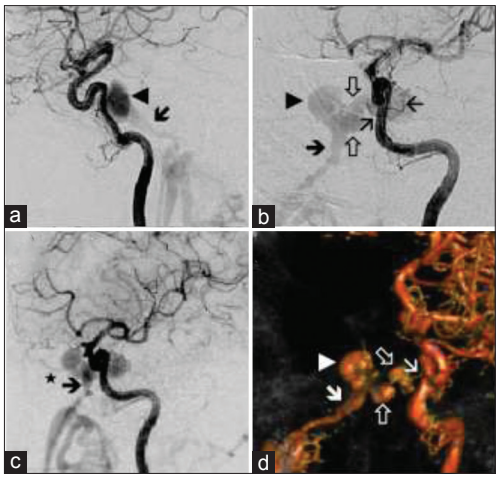

Figure 3: Digital subtraction (a: Lateral view, b: Left oblique view, and c: Later view and more lateralized than b) and selective three-dimensional (d: AP view) angiography of the left internal carotid artery. It is seen the pass to the left cavernous sinus through meningeal branches of the meningohipofisarial and inferolateral trunks (b and d, thin arrows). The contrast material passes through intercavernous sinus (b and d, arrows) into the right cavernous sinus (a, b and d, arrowheads). Retrograde flow is observed from the inferiro petrosal sinus (a, b, c and d, thick arrow) and the ophthalmic vein (c, star)

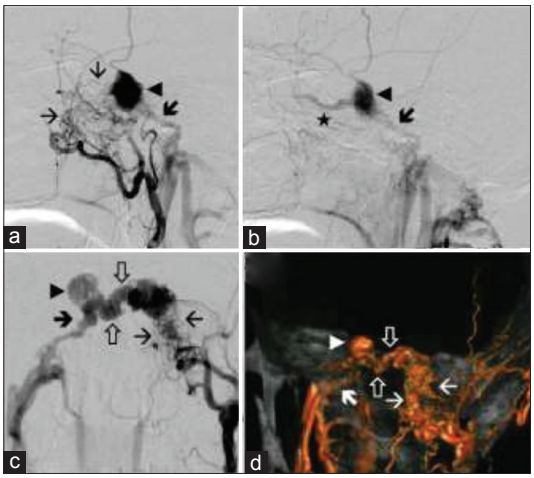

Figure 4: Digital subtraction (a: Lateral view, b: Lateral view later stage than a and c: AP view) and selective three-dimensional (d: Anterolateral view) angiography of the left external carotid artery. It is observed the passage of contrast material through direct branches of the maxillary artery and in turn the middle meningeal artery toward the left cavernous sinus (a, c, d, thin arrows). The contrast material passes to the contralateral cavernous sinus (a-d, arrowhead) through intercavernous sinus (c and d, arrows). Retrograde flow can be seen through the inferior petrosal sinus (a-d, thick arrow) and the ophthalmic vein (b, star)

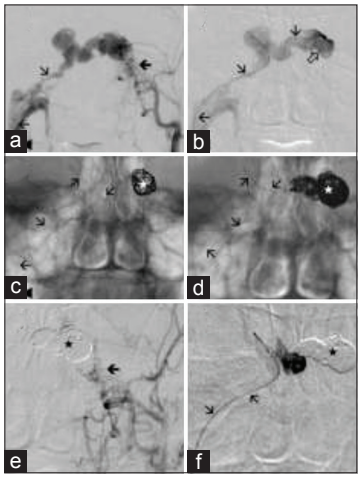

Figure 5: Fistula management by contrast injection through arterial approach, where there are visualized the tributary vessels (a, thick arrow) and venous embolization. The distal end of the guide catheter was fixed at the level of the internal jugular vein (a, b and c: Arrowhead), and through this was passed a microcatheter that coursed the inferior petrosal sinus, the right cavernous and intercavernous sinuses (a-d and f, thin arrows). The distal end of the microcatheter was placed in the left cavernous sinus (b, arrow) and was started the coils placing and releasing (c-f, Star). By the end of angiographic embolization, meningeal vessels were observed, with no communication with the cavernous sinus (e, thick arrow)

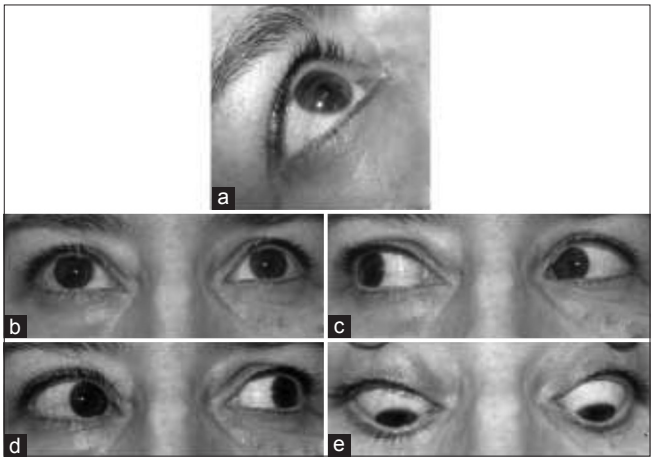

Figure 6: Photograph of AO 1 week after treatment. The proptosis, bipalpebral edema, and congestion of conjunctival vessels are no longer observed (a and b). Eye movements are conserved (c-e)

tinnitus, but these symptoms are usually less dramatic than those of direct carotidcavernous fistula and rarely are life threatening, although there are reports of significant morbidity such as blindness and stroke.[8,9]

Up to 30–40% of described cases had cerebral hemorrhage due to the rupture of dilated cerebral veins as a result of retrograde flow. The most affected eye is often the ipsilateral to the fistula, although bilateral involvement has been described due to pass of flow through circular or intercavernous sinus. In our case, the compromised eye was exclusively contralateral to the fistula.

The flow of CSDF is, usually, much lower than the direct FCC, this being the most important reason to present a less aggressive clinical spectrum. On an average 26–50% can present spontaneous recovery.[6,9,10-16] Is not rare the cure occurred shortly after performing the diagnostic angiography. Due to this, the decision on the CSDF management is controversial. Keltner *et al*. treated endovascularly only 1 of the 10 cases reported, while 7 were offered only ophthalmologic

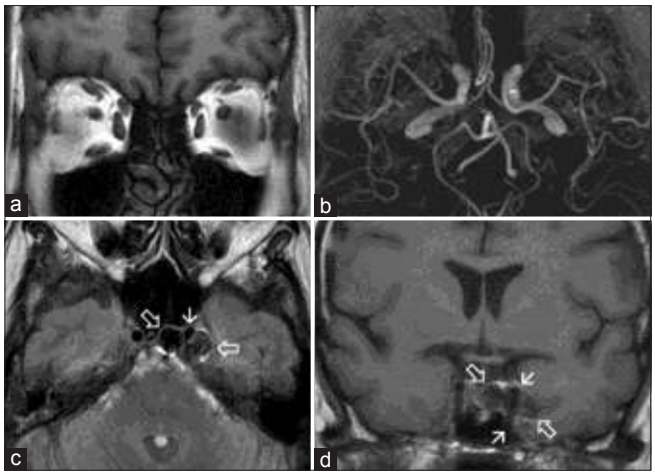

Figure 7: Magnetic resonance imaging 15 days after endovascular treatment. At orbital level is no longer observed extraocular muscle edema or bulking ophthalmic veins (a). The tetralogy of fallot angio magnetic resonance imaging shows absence of the fistula (b). Can be appreciated hypointensity originated by coils within the left cavernous and intercoronary sinuses (c and d, arrows), besides the signal absence of blood flow within the internal carotid artery (c and d, arrows)

management with treatment for glaucoma, reporting good control, therefore, they conclude that these cases should not be subjected to definitive treatment.[6]

Currently are considered as indications for definitive treatment of CSDF the rapidly progressive deterioration of the visual function, abnormal cortical venous drainage, the hypoxic retinal and optic nerve consequences, ischemic keratitis, and the disabling tinnitus.[3,5,11,16] The case we report was discussed by the lack of improvement in IOP and the presence of intractable tinnitus.

It is now considered neurological endovascular therapy as the treatment of choice for all types of FCC, since it can be practiced under local anesthesia with the possibility of ongoing clinical evaluation of the patient for early detection of any complication, carries little risk, little time during the procedure, vessels reached surgically inaccessible sites, has more chance of preserving the flow of ICA, patient early recovery, and because there is always the possibility of repeating the procedure in case of initial failure or recurrence.[1,3,5,7,11,16,17]

In endovascular management of CSDF has been determined the cavernous sinus occlusion as definitive treatment in some cases. For this purpose, can be used the venous access as the best accessing method for insertion and release of embolic material, with preference for the use of detachable coils. Have been described and used different routes to reach the cavernous sinus, such as the inferior petrosal sinus, basilar plexus, circular sinus through the facial vein, the angular vein and superior ophthalmic vein,[3-5,11,17-23] even, have been made the approach through the pterygoid plexus or cortical veins.[17,18]

In a large retrospective study, Meyers *et al*., summarize 15 years of experience in the management of 135 CSDF patients treated transvenously, coils were used in 87% of cases, pieces of suture material in 13% and in 3% liquid adhesive material.[3] They reported good long-term results in 97% of cases.

Cheng *et al*. described 27 patients treated by transvenously with GDC coils and fibered coils, where only one case was necessary to combine with the arterial line for administration of polyvinyl alcohol particles. The study found angiographic cure in 89% of cases.[17]

Klisch *et al*., reported 11 cases of CSDF embolized by transvenous approach with coils, reaching an anatomical cure rate of 63%, however, state that all patients, including those who did not achieve such healing, showed improvement in their symptoms.[11] In our article, that is being published, we present a previous series of cases, we expose that, like Viñuela *et al*.[16] and Higashida *et al*.,[5] our preference for the arterial approach in selected cases of CSDF, in order to promote occlusion by thrombosis of both the distal portion of the arterial tributaries of greater participation and also the initially committed part of the cavernous sinus.

In the case reported here we decided to use the venous approach due to the large number of small tributaries from the ECA difficult to treat through the arterial approach, as well as the involvement of the ICA. Although the fistula was left, commitment right cavernous sinus via the coronary sinus motivated contralateral access. Many times the contralateral access is difficult or impossible because the contraletaral intercavernous or the cavernous sinus are separated or highly trabeculated.[11] Injury to the access vein, the immediate and rapid increase of the ophthalmological symptoms, and the injury of some of the oculomotor nerves have been reported as a complication of venous approach.[6,13,17,24-27]

Conclusions

Cavernous sinus dural fistula, usually, occurs in postmenopausal women, but can occur in other age groups. CSDF are characterized clinically by ophthalmological symptoms and pulsatile tinnitus, but these symptoms are usually less dramatic than those of direct carotidcavernous fistula and rarely are life-threatening, although there are reports of significant morbidity such as blindness and stroke. Neurological endovascular therapy, is now considered as the treatment of choice for all types of CSDF, since it can be practiced under local anesthesia with the possibility of ongoing clinical evaluation of the patient for early detection of any complication, carries little risk, little time during the procedure, vessels reached surgically inaccessible sites, has more chance of preserving the flow of ICA, patient early recovery, and because there is always the possibility of repeating the procedure in case of initial failure or recurrence.

Indications for definitive treatment of CSDF are the rapidly progressive deterioration of the visual function, abnormal cortical venous drainage, the hypoxic retinal and optic nerve injuries, ischemic keratitis, and the disabling tinnitus.

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