SAS Journal of Medicine
Abbreviated Key Title: SAS J Med
ISSN 2454-5112
Journal homepage: https://saspublishers.com

OPEN ACCESS

Case Report of a Post-Traumatic Carotido-Cavern Fistula

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DOI: 10.36347/sasjm.2021.v07i10.006 | **Received:** 06.07.2021 | **Accepted:** 14.08.2021 | **Published:** 05.10.2021

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Abstract **Case Report**

Carotid-cavernous fistulas (CCF) are defined as abnormal vascular communication between the internal and external carotid arteries or their meningeal branches and the cavernous cavity. The objective of our work is to show the radiological signs allowing the diagnosis of a carotid-cavernous fistula. We report the case of a 40-year-old patient with a left carotid-cavernous fistula following a head trauma, who consulted the emergency room 3 days after his trauma because of persistent pulsatile headaches and the appearance of a left exophthalmos. A CT scan, a Doppler ultrasound followed by a cerebral MRI after injection of contrast medium were performed. An angio-MRI confirmed the diagnosis and showed the presence of a left carotid-cavernous fistula. The mode of revelation of post-traumatic CFC is often stereotyped and the association of intracranial murmur and pulsatile exophthalmos immediately evokes the diagnosis. Cross-sectional brain imaging allows the diagnosis to be made. Arteriography remains irreplaceable to confirm the existence of the breach and to analyze all the angiographic elements that will be important at the time of the final therapeutic decision. The diagnosis of carotid-cavernous fistula suspected clinically is confirmed on imaging in the presence of evocative signs.

Keywords: Carotid-cavernous fistulas (CCF), angio-MRI, Post-Traumatic, road traffic accident.

INTRODUCTION

Carotid-cavernous fistula (CCF) is an abnormal communication between the internal carotid artery in its intracavernous portion and the cavernous sinus. It is a rare but not exceptional complication of craniofacial trauma and is diagnosed clinically. The deep location of the cavernous sinus makes surgical treatment difficult [1]. Because of their potential seriousness, it is important to recognize them early. The context is particularly evocative since 90% of CFCs occur in the context of a head injury. The current main therapeutic attitude is focused on interventional neuroradiology [2].

OBSERVATION

We report the case of a 40-year-old patient with no previous history of head injury following a road traffic accident with a cranial impact point, who consulted the emergency room 3 days after his injury because of persistent pulsatile headaches and the appearance of a left exophthalmos.

A CT scan, a Doppler ultrasound followed by a brain MRI after injection of contrast medium were performed. The initial cerebral CT scan (Figure 1) showed a comminuted fracture of the left sphenoidal sinus compartment with hemosinus without any significant abnormality in the cavernous cavity.

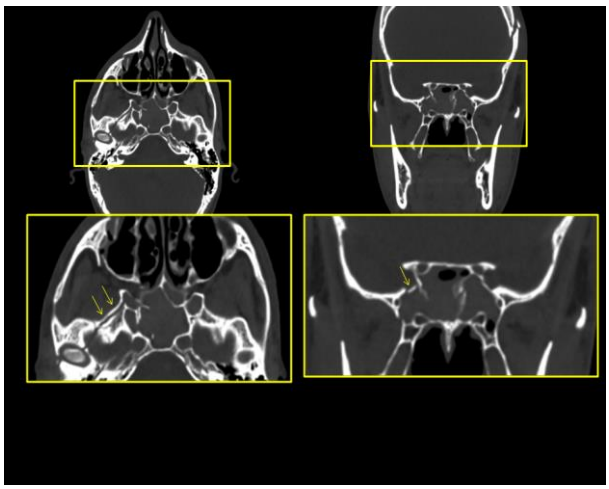

Figure 1: Victim of a traffic accident, the brain scan shows a comminuted fracture of the left compartment of the sphenoidal sinus with hemosinus without any notable anomaly in the cavernous cavity

One year later, the patient was referred for exophthalmos with headaches. The CT scan (Figure 2) showed enlargement of the cavernous cavity and the homolateral sphenoidal fissure, grade III left exophthalmos, dilatation of the superior ophthalmic vein and thickening of the left orbital cone muscles.

Doppler ultrasound showed arterialization of the left superior ophthalmic vein and hypervascularization of the oculomotor muscles.

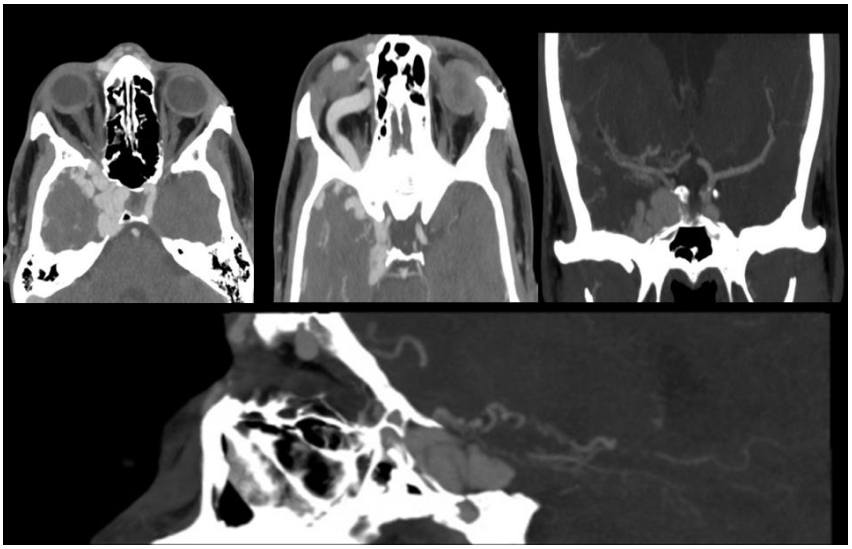

Figure 2: One year later the patient was referred for exophthalmos with headaches. The CT scan showed an enlargement of the cavernous cavity and the homolateral sphenoidal fissure with a dilated aspect of the right carotid siphon in its intracavernous portion and of the superior ophthalmic vein, with the development of a craniofacial collateral arterial circulation associated with a left exophthalmos grade III, an aspect suggestive of a posttraumatic carotidocavernous fistula

An angio-MRI (Figure 3) showed the presence of a left carotid-cavernous fistula.

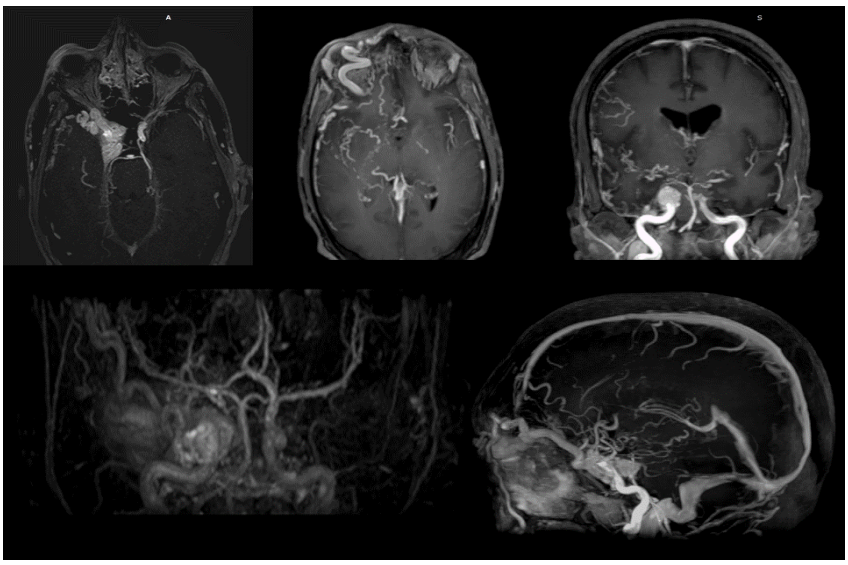

Figure 3: Enlarged aspect of the right cavernous sinus with convex external limit, tortuous and dilated aspect of the right carotid siphon in its intra cavernous portion and of the homolateral superior ophthalmic vein

DISCUSSION

Carotid-cavernous fistula is an abnormal communication between the internal carotid artery and the cavernous sinus and is the most frequent form of post-traumatic cerebral arteriovenous fistula. It is a rare but not exceptional pathology with a traumatic etiology found in 75% of cases. Some authors have found a frequency of 3.1% in skull base fractures [1].

The mechanisms incriminated in the genesis of post-traumatic SCC are of three kinds: a tearing under the effect of the shock of intra-cavernous arterial branches of the carotid siphon; a rupture of a pre-existing aneurysm or an arterial wound secondary to the displacement of a bone fragment in the great

craniofacial fractures, and in particular the fractures of the base of the skull [1].

The onset of symptoms varies from a few weeks to a few months. Clinical signs are dominated by ophthalmologic manifestations.

The clinical signs are dominated by ophthalmological manifestations, which are expressed by the Dandy triad: murmur, exophthalmos and conjunctival chemosis [3].

Auscultation of the periorbital and temporal regions reveals a systolo-diastolic intracranial murmur that disappears with manual compression of the homolateral carotid artery at the neck [1]. Abnormal communication between the intracavernous portion of the internal carotid artery and the cavernous sinus. This communication is most often direct at high flow due to a breach of the arterial wall in the cavernous sinus (classified as type A according to Barow *et al*., Exceptionally, it is of indirect type at low flow (B, C or D) due to a lesion of the dural wall of the cavernous sinus, creating micro-shunts between the meningeal branches of the internal and/or external carotid arteries and the venous sinus [4].

The gold standard for diagnosis is digital subtraction angiography. Nevertheless, the initial diagnosis often relies on non-invasive means such as CT angiography or magnetic resonance angiography [3].

Once the diagnosis of fistula has been evoked, orbital CT or MRI can be used to look for indirect signs such as enlargement of the cavernous sinus, dilatation of the superior ophthalmic vein.

CT scan quantifies exophthalmos by measuring the oculo-orbital index, looks for dilatation of the superior ophthalmic vein and bulging of the cavernous sinus, which are indirect signs of fistula. [1]

The diagnosis is based on angioscan evidence of arterial enhancement within the cavernous sinus, dilatation of the superior ophthalmic vein with early enhancement is very sensitive, while dilatation/enhancement of the superior pterygoid sinus and venous plexus and exophthalmos is very specific [3].

Asymmetric enlargement of the cavernous sinus has low specificity and is a potential diagnostic pitfall that can lead to false-positive diagnoses [5].

Choroidal effusion on CT may be another indirect sign of carotid-cavernous fistula or may complicate an endovascular procedure in rare cases [6].

Brain MRI without contrast injection, confirms exophthalmos and dilatation of the superior ophthalmic vein which is the most suggestive indirect sign of carotidocavernous fistula. Orbital MRI in T1 sequence shows dilatation of the superior ophthalmic vein (hypersignal if thrombosis, hyposignal if rapid flow), enlargement of the homolateral cavernous sinus. In T2 sequence, it allows a better visualization of the cavernous sinus [6, 7].

Angiomicrography can also help in the positive diagnosis thanks to the "time-of-flight" sequence, which provides a sensitivity of 83% and a specificity of almost 100% for carotid-cavernous fistulas [3].

The color Doppler ultrasound allows to confirm the arteriovenous fistula by showing a reversed Doppler signal in the ophthalmic veins associated with a hyper flow, this arterialization of the venous flow is translated in the pulsed Doppler by a reversed Doppler signal directed towards the face with systolic reinforcement, the resistance indexes are low and the maximal systolic speeds are very high (50 cm/s). This examination also allows non-invasive follow-up after embolization or therapeutic abstention [3].

Transcranial Doppler directly visualizes the fistula with a sensitivity of 95%. It can be associated with a compression maneuver of the homolateral carotid artery, allowing to appreciate the vascular supplements in order to foresee the possible disturbances of the cerebral hemodynamics if an internal carotid axis is sacrificed. The resistance values are low and the maximum systolic speeds are very high (50 cm/s) [1].

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However, arteriography remains the key examination in this pathology. It has a double interest: diagnostic and therapeutic. Indeed, it allows to confirm the diagnosis and to localize the fistula as well as the afferent and efferent pathways and also allows a therapeutic gesture by embolization. It should not be performed in emergency unless a therapeutic procedure is envisaged [3-6].

CONCLUSION

Post-traumatic carotid-cavernous fistulas are a rare pathology, more frequently encountered when there is a skull base fracture.

The visualization of direct or indirect signs on cerebral CT and MRI angiography should lead to the performance of cerebral angiography, a reference examination, both diagnostic and therapeutic.

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