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Case Report

Carotid occlusion of a giant intracavernous aneurysm on a single functional internal carotid artery ☆

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ABSTRACT

The prevalence of intracranial aneurysms (IA) is higher in patients with stenosis of the internal carotid artery (ICA), the intracavernous internal carotid aneurysm is an intracranial aneurysm causing major functional and vital complications. We report the case of a 26-year-old man who consulted for a reduction in visual acuity, converging strabismus and ptosis of the right eye evolving for 7 months before his consultation, the various neuro-radiological examinations made it possible to identify diagnose a giant aneurysm of the right intracavernous internal carotid artery associated with severe stenosis of the contralateral internal carotid artery, hence the performance of a therapeutic arteriography consisting of an occlusion of this aneurysm. In summary, we describe successful management of a giant aneurysm of the intracavernous portion of a single functional internal carotid artery, while preserving optimal cerebral vascularization.

Introduction

Intracranial aneurysms (IAs) have been shown to be associated with conditions that alter intracranial blood flow, such as vasculopathies, and atherosclerotic arterial stenosis or occlusion [2,3]. Aneurysm of the intracavernous portion of the internal carotid artery is a rare type of IAs, causing serious complications that can compromise the visual functional or vital prognosis. The cavernous sinus is the place of passage of a large vascular and nervous bundle destined for the orbit, hence the revelation of this type of aneurysm by rich ophthalmological symptoms dominated by oculomotor paralysis Surgical access to the cavernous sinus is difficult and causes significant associated lesions. The endovascular approach constitutes the standard treatment route in these pathologies.

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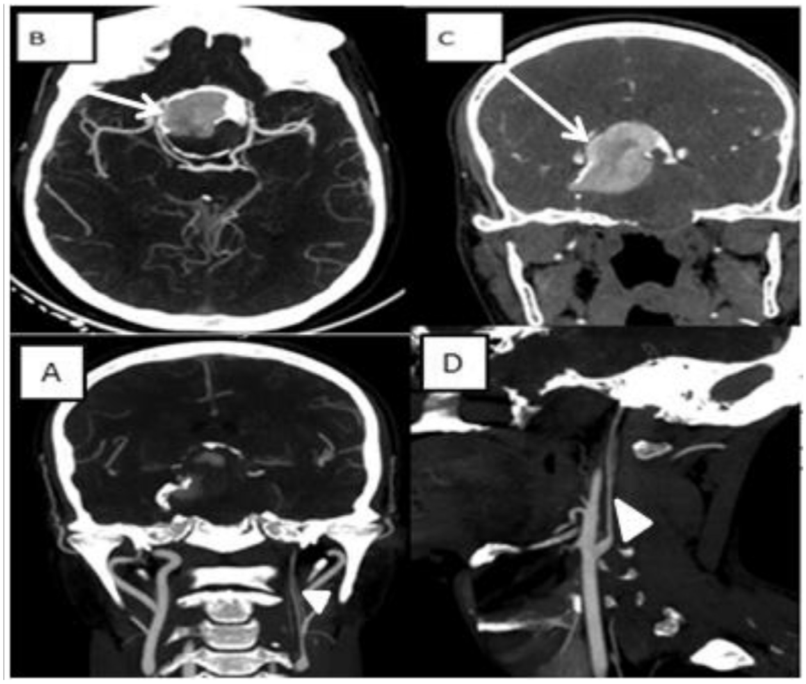

Fig. 1 – Brain CT with spontaneous contrast and after injection of the iodinated contrast product in the arterial phase in axial (B), and coronal (A, C) and sagittal (D) reconstructions, showing: addition image of the right internal carotid artery (white arrow) , heterodense, seat of parietal calcifications, and a marginal thrombus, as well as a central circulating portion (B and C), related to an aneurysm appearing to depend on the intracavernous internal carotid artery, associated with a several stenosis of controlatéral internal carotid artery (arrowhead).

Case report

We report the case of a 26-year-old patient, who consulted for a decrease in visual acuity in the right eye with oculomotor paralysis dating back to 7 months before his consultation. The clinical examination revealed a conscious patient, with III paralysis, ptosis, and converging strabismus of the right eye, without papilledema at the fundus. The neurological examination was unremarkable, in particular, no sensory-motor deficit.

In this situation a right cavernous syndrome of rapidly progressive installation was mentioned, hence the realization of a cerebral CT angioscan with an acquisition at the cranial level without and after injection of the iodinated contrast producting the arterial and venous phase, which objective a voluminous addition image at the expense of the right internal carotid artery, oval in shape, lobulated contours, oriented upwards and forwards, spontaneously hyperdense, heterodense, seat of a marginal thrombus as well as parietal calcifications, measuring 54 × 33 × 54 mm in diameter, with a neck measured at 04 mm, related to an intracavernous carotid aneurysm (Fig. 1).

A diagnostic angiography was performed on March 5, 2023: under local anesthesia, after a puncture of the right femoral artery, placement of a 5F introducer, and catheterization of the internal carotid artery and the right external carotid artery, the left common carotid artery and the left vertebral artery, showing a large partially thrombosed aneurysm at the level of the cavernous compartment appearing to be at the expense of the right internal carotid artery. It also revealed a very filiform appearance of the left internal carotid artery, with irrigation of the 2 sylvian arteries by the 2 posterior communicating ones (Fig. 2).

On October 4, 2023 the patient was a candidate for endovascular treatment of his aneurysm, which consisted of embolization of it preceded by a right carotid clamping test initially using awake angiography, than no additional deficit sign or modification of the neurological examination was observed. The second stage consisted of embolization of the right internal carotid artery after general anesthesia of the patient, which took place according to the following steps (Fig. 3).

- Positionnement of a micro catheter at the level of the carotid terminal upsteam of the ophtaloc artery, the posterior communicating and right choroidal arteries.
- Inflated balloon within right side carotid canal.
- Use embolization to sandwich the aneurysm, because of the no stabilization of the coils within the carotid terminal upstream of the right ophtalmic artery.
- Coiling of the aneurysme complex as well as the carotid terminal using coils whose overall length is estimated at 3.8 m (Axium) and 4.6 m (MicroPlex).
- At the end of the procedure : visualization of an opacification of postérior surface of the aneurysm via the right carotid terminal.
- Successful right carotid occlusion.

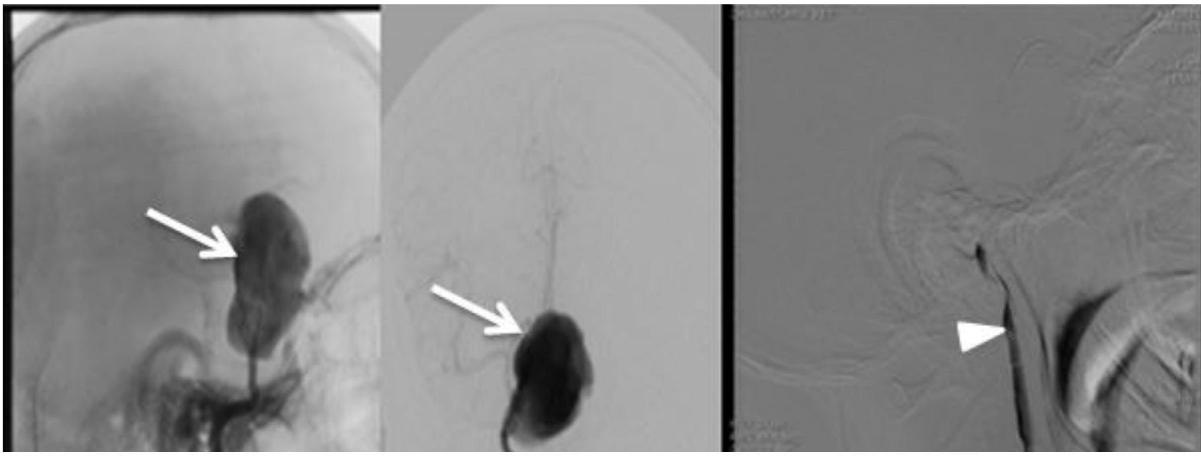

Fig. 2 – Arteriographic images showing a voluminous addition image of the cavernous compartment of the right internal carotid artery (white arrow), related to the partially thrombosed aneurysm, with a very filiform appearance of the left internal carotid artery related to its chronic occlusion (arrowhead).

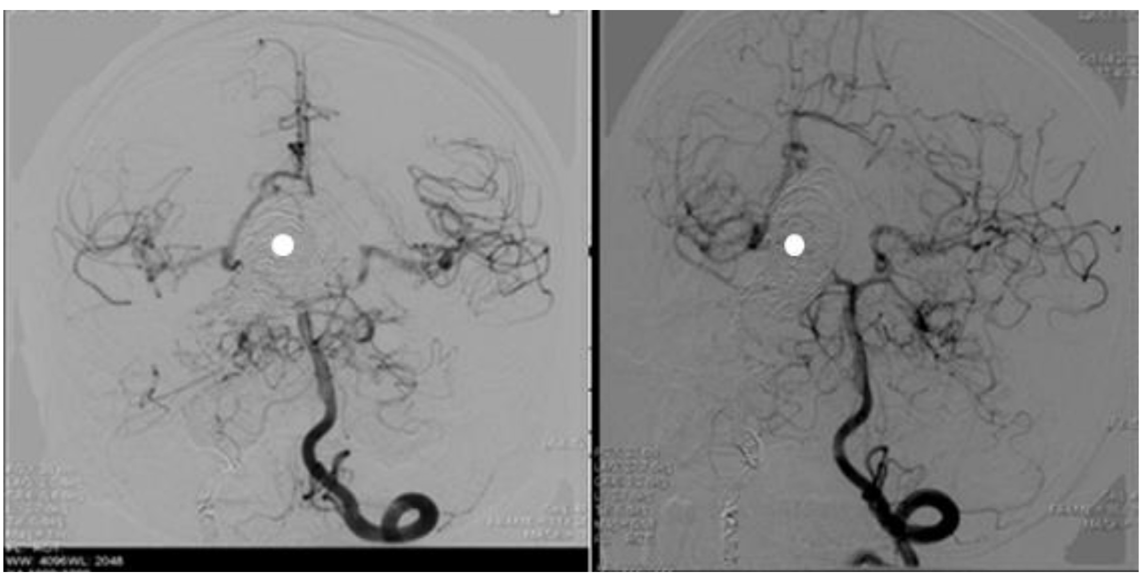

Fig. 3 – Arteriographic images showing the post-embolization result of the right intracavernous internal carotid aneurysm. Note the total occlusion of the large aneurysm by the coils (white circle).

- Functional Willis polygon, without cortical or proximal occlusion on its arteries with good replacement from the posterior communicating ones.
- Removal of the 06 F introducers and manual compression at the end of the procedure.
- Neurological examination on unmodified examination table.

Discussion

The aneurysm of the intracavernous internal carotid artery is extremely rare and constitutes 3% to 5% of all intracranial aneurysms [4], it preferentially affects women with an average age of 48 years. Its etiologies are dominated by arterial hypertension, traumatic etiology and connective tissue abnormalities [5]. This anatomical location explains the richness of the ophthalmological symptomatology which is dominated by ophthalmoplegia (93%) and ptosis (51%) [6]. In cases of isolated paralysis, it often involves the abducens nerve VI followed by the common oculomotor nerve III.

The prevalence of coexistence of internal carotid artery (ICA) stenosis and intracranial aneurysm (IA) is a 6.3% according to Yang and Al, which is more than twice the prevalence of incidentally found intracranial aneurysm in the general population [1]. This value includes intracranial aneurysm both ipsilateral and contralateral to the ICA stenosis. Although the exact mechanisms underlying IA formation in the setting of ICA stenosis have yet to be fully defined, it is postulated that hemodynamic changes in the intracranial vasculature heavily influence IA development. For IA ipsilateral to the stenosis, at least initially, autoregulation distal to the stenotic ICA likely leads to increased blood flow, increased blood flow velocity, and greater wall stress in the intracranial vasculature. As the stenosis progresses, flow to the intracranial circulation may decrease, or stop, in cases of complete occlusion. Examination of flow rate through a stenotic vessel has been demonstrated to remain stable, until the stenosis reaches 75%, at which point a significant reduction is observed [7]. Severe ICA stenosis (75%–99%) results in a 35% reduction in blood flow through the artery, whereas occlusion also leads to a 14% flow reduction in the ipsilateral middle cerebral artery (MCA) [8]. This may explain the reported higher number of patients with multiple contralateral aneurysms than with multiple ipsilateral aneurysms. In addition, the eventual significant drop in flow through the stenosis likely also contributes to the finding that IA ipsilateral to ICA stenosis are of a mean smaller size than those IA located contralateral to ICA stenosis. In those IA contralateral to the ICA stenosis, it is likely that the increased metabolic demand on the nonstenotic vessel increases blood flow, stretch, and hemodynamic stress distal to the nonstenotic vessel. Furthermore, these hemodynamic stresses are likely greatest at the sites of collateralization between the circulations (ACOM and PCOM). A recent quantitative magnetic resonance angiography study to assess hemodynamic changes that may lead to IA showed higher wall shear stress and flow velocity across vessels that provide collateral blood supply in the setting of ICA occlusion, namely the ACOM and PCOM [9]. Additional studies have reported larger aneurysm sizes on the side contralateral to a stenotic ICA [10].

Cerebral CT angiography constitutes the first-line efficient examination to establish the diagnosis. Angiography is essential both for very precise lesion mapping but also for endovascular treatment. The evolution of these aneurysms is characterized by a progressive increase in their size observed by angiographic controls in the absence of treatment. But spontaneous thrombosis of the aneurysm has been described in a few cases [11]. Oculomotor paralysis can in principle recover without treatment, after surgical exclusion of the aneurysm and after endovascular treatment [12,13]. Most recovery occurs early, but it can be seen after several months, or even after more than a year and a half [14]. Surgical exclusion reduces the mass effect and pulsatility of the aneurysm and can reduce clot mass in the event of rupture. Endovascular treatment by filling the sac with metal coils also reduces its pulsatility [14]. An aneurysm that has become symptomatic due to oculomotor paralysis, even if not ruptured, could reflect the enlargement of the aneurysmal sac, with a significant risk of bleeding, which indicates its treatment [15]. Treatment requires close collaboration between radiologists, neurosurgeons and ophthalmologists. It depends on the size of the aneurysm, its location, the possible presence of a collar but also the clinical condition of the patient [16]. This treatment can be carried out either surgically or endovascularly. The place of interventional neuroradiology seems indisputable in first-line treatment. The indications for surgical sacrifice of the carotid artery currently boil down to the failure of endovascular techniques [17].

Conclusion

The aneurysm of the intracavernosal carotid artery is a rare type of Intracranial aneurysms whose association with controlateral internal carotid stenosis or occlusion has been described, it affects the visual and vital prognosis in the event of an intracavernosal rupture. Endovascular treatment constitutes the reference therapeutic method for this pathology, making it possible to prevent serious complications that may follow surgical intervention.

Patient consent

Written informed consent for the publication of this case report was obtained from the patient.

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