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The intravascular treatment of a cavernous fistula caused by rupture of a traumatic carotid trigeminal aneurysm

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Summary. The authors report the particular treatment of a traumatic cavernous fistula caused by the rupture of an exceptional lesion: a false aneurysm of the C5 segment of the right carotid artery situated at the origin of a persistent trigeminal artery.

Key-words: Intravascular treatment - Head injury - Traumatic aneurysm - Trigeminal artery - Carotid cavernous sinus fistula

Traumatic aneurysm developed on the intracavernous segment of the internal carotid artery is a rare lesion [1-3]. Its rupture leads to a cavernous fistula and even to severe recurrent epistaxis when the aneurysm communicates with the sphenoid sinus [4, 5]. To our knowledge, a post-traumatic aneurysm on the carotid origin of a trigeminal artery, followed by a cavernous fistula has never been described in the literature.

At the present time, interventional neuroradiology (and in particular a detachable balloon catheter device) is the suggested treatment [6, 7]. In our case, this treatment was conducted in a very special manner, the particular aspect of which and the singularity of the lesion are important to report. This article also emphasizes the necessity of an exhaustive angiographic study as soon as the clinical diagnosis of carotid cavernous sinus fistula is suspected.

Case report

G... Antoine, 35 years old, victim of a road accident was admitted unconscious after head trauma with bilateral otorrhagia worse on the right. The radiologic study revealed an axial fracture of the right petrous pyramid extending to the mastoid process and to the roof of the external auditory canal. On the left, there was also as an axial fracture of the petrous pyramid, extending to the mastoid. The sphenoid bone was fractured across the chiasmatic groove with a hemosinus. Eleven days after the head injury, the patient had satisfactorilly recovered consciousness but presented a right pulsatile exophtalmos with chemosis, total ophtalmoplegia, and a pulse-synchronous bruit. The visual acuity was preserved.

Angiographic study confirmed the clinical diagnosis of right cavernous sinus fistula (Fig. 1 a and b). The contralateral carotid angiogram demonstrated two dissecting aneurysms on the intracranial part of the internal carotid: one near the foramen lacerum, the other a few millimetres above, on the C5 segment of the artery. Another similar lesion was observed on the posterior wall of the cervical part of the artery, in front of the atlas (Fig. 2 a and b).

Endovascular treatment of the right cavernous fistula by detachable balloon technique was considered and is worth describing in detail. After the introducer had been placed in the internal carotid in the usual way, the 1 ml balloon catheter was easily introduced into the cavernous sinus. Inflation of the balloon did not interrupt the blood flow through the fistula. After several unsuccessful attempts to set the catheter in a correct position, it was decided to replace it by a balloon of greater capacity. Because of palpable resistance keeping the elastic fastening on the catheter, the catheter was given a sharp tug so that the balloon finally reached the carotid and was drawn out intact. The control injection under fluoroscopy revealed to our surprise that the fistula had disappeared.

The angiogram confirmed that the closure of the fistula had been achieved, but showed the existence

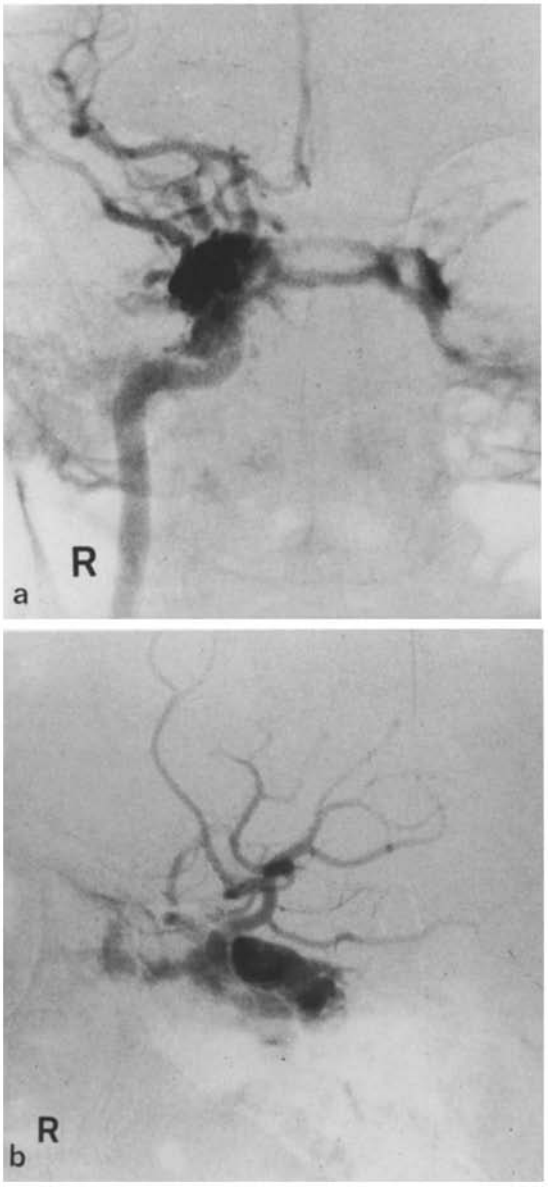

Fig. 1a and b. Frontal (**a**) and lateral (**b**) right internal carotid angiograms. Demonstration of a carotid cavernous fistula

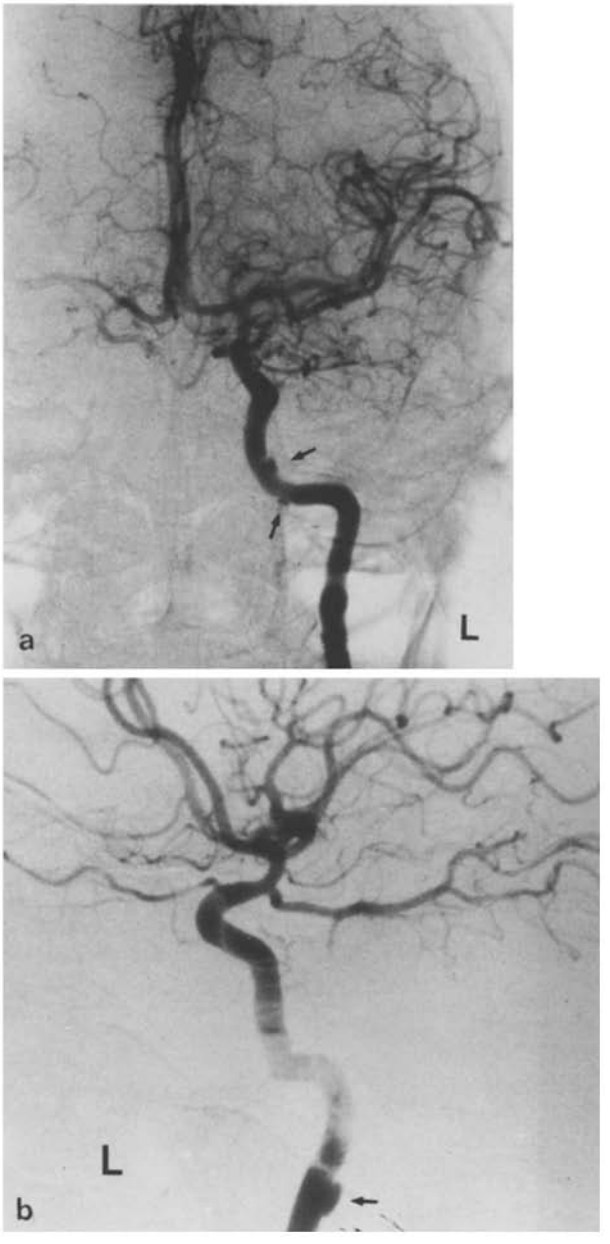

Fig. 2a and b. Frontal (**a**) and lateral (**b**) left internal carotid angiograms. Three dissecting aneurysms are seen (→)

of an aneurysmal lesion composed of two superimposed sacs on the external wall of the C5 segment of the internal carotid, at the origin of a trigeminal artery (Fig. 3a and b). The carotid presented a regular stenosis in relation to the injury, though, in the lateral projection, it showed an irregular outline. This voluminous ectasia and the embryonic artery had not been seen during the first investigation because of a massive leak of contrast medium through the fistula. The patient's ophtalmologic tests, with the exception of a paresis of the VI right nerve, very quickly returned to normal.

Eight days later, a right carotid angiogram confirmed the cavernous fistula occlusion and the presence of a carotido-trigeminal aneurysm whose morphology had radically deeply changed: the inferior sac could no longer be seen. The upper sac looked like a voluminous dissecting aneurysm, its outline smooth and regular. The carotid artery still presented a stenosis (Fig. 4a and b). The only handicap the patient presented one year after the treatment was a right VI nerve paresis. At that time, an examination of the right carotid system by doppler was normal. Two years after the intervention, the paresis of the VI

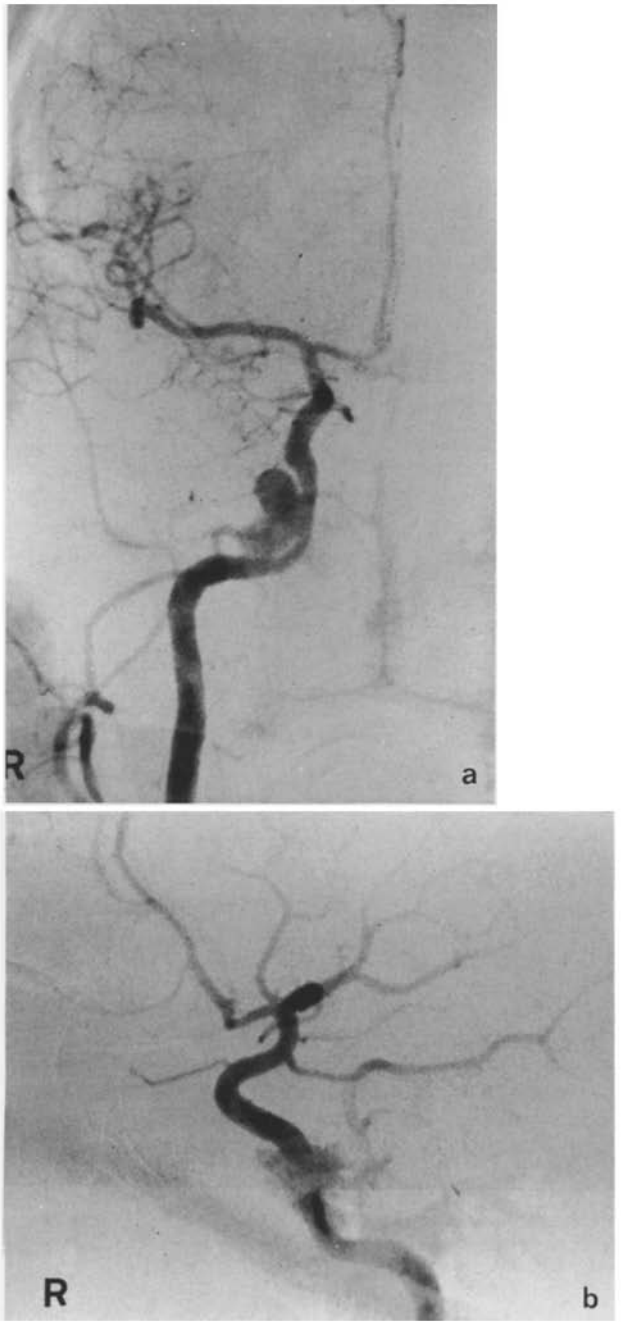

Fig. 3a and b. Frontal (**a**) and lateral (**b**) right internal carotid angiograms during intra-arterial treatment. Occlusion of the cavernous fistula. The aneurysm and the trigeminal artery are well seen

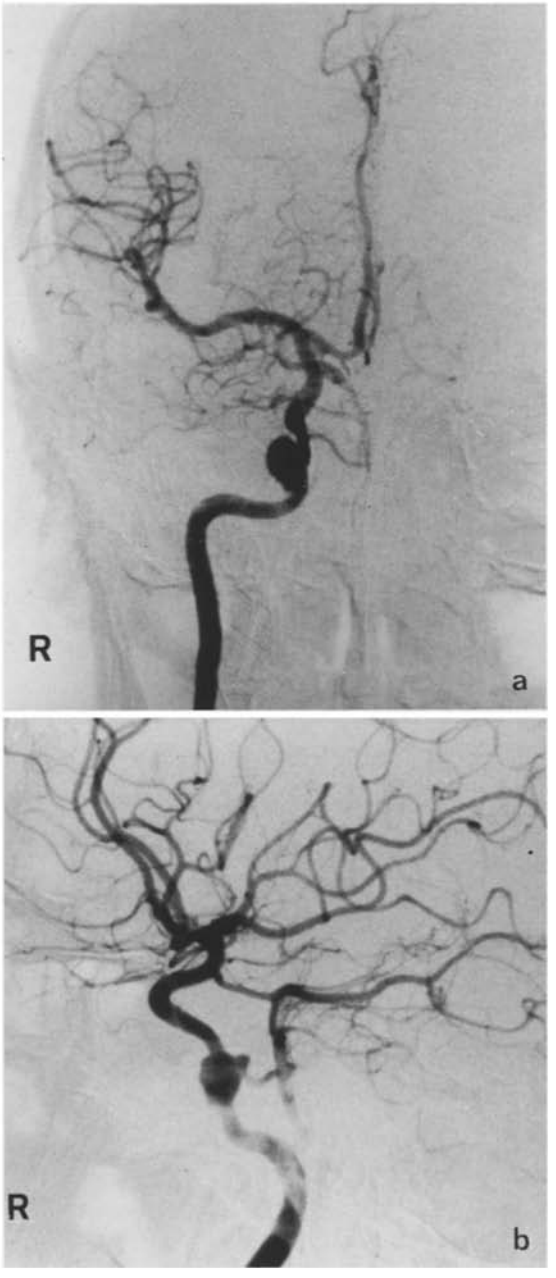

Fig. 4a and b. Frontal (**a**) and lateral (**b**) right internal carotid angiograms eight days after the intervention. The aneurysm morphology has changed

nerve had disappeared. Neuro-ophtalmologic examination is strictly negative.

Discussion

Cavernous fistulae caused by rupture of traumatic carotid-trigeminal aneurysms are exceptional. The two cases published in the literature differ from the one we present here, both observations being concerned with spontaneous rupture of congenital aneurysms. These fistulae had been treated by ligature of the internal carotid in one case [8] and by an attempt at endovascular occlusion by detachable balloon technique with obstruction of the fistula two days later in the other [9]. Cases of congenital trigeminal artery aneurysm have also been described [10–13].

The particular morphology of our case oriented us in the beginning more towards a false aneurysm, probably of dissecting type, than towards a real congenital aneurysm. We were surprised by the exact symmetry of the lesion with that on the C5 segment of the contralateral internal carotid. The disappearance of the inferior sac, seven days after the treatment and the lack of a neck could argue in favour of the acquiered character of the lesion.

Beyond the exceptional nature aspect of these observations, we are led to comment on the diagnosis and treatment of the fistula. The presence of a trigeminal artery and of a false carotido-trigeminal aneurysm was unknown during the first bilateral angiographic investigation. Though the normal flow of the circulation in the trigeminal artery is from the internal carotid to the the basilar artery, a vertebral angiography would certainly have enabled us to recognize and study the different anomalies thanks to the deviation of the flow due to the fistula. The astonishing result of the treatment of the fistula can only be explained by the presence of a kind of valve, located at the site of the tear, that would have been reversed by the traction during the difficult removal of the detachable balloon. Fortunately the balloon did not detach from the catheter at that moment. Finally, we have to recall the anatomical relations of the trigeminal artery to explain the slow recovery of the right VI nerve although all the other clinical signs had quickly disappeared [14, 15]. The former issues from the internal carotid as it enters the cavernous sinus. It runs backwards either through the sella turcica and the clivus, or between the V nerve laterally and the sella turcica medially. It is generally connected with the basilar artery close proximally to the origin of the superior cerebellar arteries. Thus, the artery is close to the III, IV, V nerves and particularly with the VI nerve which is situated just under the origin of the artery at the place where the latter perforates the dura. Thus we can conceive that the space-occupying arterial lesion, precisely situated at that spot caused a lesion of the VI nerve. Its complete recovery, two years after the intervention could perhaps be explained by a decrease of volume or even a disappearance of the lesion. In fact, the decrease of volume was already well demonstrated by angiography directly after the occlusion of the fistula. Unfortunately, a long-term angiographic control could not be carried out.

Conclusion

Though anecdotal, the observations in this case give us two valuable pieces of advice:

- the necessity to make an angiographic exploration as complete as possible: with this kind of pathology, the investigations must include the study of both the carotid and vertebro-basilar systems;
- the efficacy of the intravascular treatment of cavernous fistula. Even though, in this case things did not develop in a classical manner when we released the balloon in the sinus, it nevertheless resulted in a cure.

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