ELSEVIER

Dural Waisting as a Sign of Subarachnoid Extension of Cavernous Carotid Aneurysms: A Follow-Up Case Report

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OBJECTIVE
Even when augmented by CT and MRI, it can be difficult on angiography to predict which intracavernous carotid artery aneurysms (ICCAA) have subarachnoid extension and therefore pose a higher risk of subarachnoid hemorrhage. Previously we reported a case of an ICCAA, which on angiogram had a focal tapering of the dome that we termed a "waist." At surgery this lesion was found to have subarachnoid extension. We postulated that this dural "waisting" on the arteriogram was a predictor of subarachnoid extension. Herein we report a second case of an ICCAA with the angiographic appearance of a waist that was also confirmed to have subarachnoid extension at surgery, thereby strengthening our original hypothesis.

CLINICAL PRESENTATION
A 40-year-old woman presented with a 3-month history of bitemporal headache, diplopia, and a left sixth nerve palsy. MRI showed a lesion in the vicinity of the left cavernous carotid sinus and an arteriogram confirmed the presence of a large cavernous carotid aneurysm. As in the previous case, the aneurysm fundus was indented, creating a waist on the aneurysm dome.

INTERVENTION
After passing a trial balloon occlusion of the involved carotid artery, the patient was brought to the operating room for lesion trapping. The aneurysm fundus was seen to extend beyond the falciform ligament and with subsequent dissection, the neck of the aneurysm was seen to incorporate the carotid artery distal to the ophthalmic artery. The aneurysm was trapped by ligating the internal carotid artery in the neck and by placing a clip on the intracranial carotid proximal to the posterior communicating artery.

CONCLUSION
The presence of subarachnoid extension of an ICCAA can be difficult to elucidate on an arteriogram. This is an additional case in which a focal narrowing or "waisting" of the aneurysm dome seen on an angiogram served as a marker of subarachnoid extension.

KEY WORDS
Aneurysm, cavernous carotid, angiography.

Intracavernous carotid artery aneurysms are notable for their benign natural history and low rates of subarachnoid hemorrhage. However, case reports of subarachnoid rupture of cavernous carotid aneurysms have been reported, with bleed rates in larger series between 1.4 and 11%, depending on the criteria used to define intracavernous [4,5]. Even when aided by CT and MRI, it can be difficult on an angiogram to predict which cavernous aneurysms have subarachnoid extension and therefore pose a higher risk of subarachnoid hemorrhage (SAH). Three years ago, we reported a case of a cavernous carotid aneurysm, which on arteriography showed a fundal indentation [3]. We hypothesized that this waist along the aneurysm dome was secondary to protrusion of the lesion through the dural margin into the subarachnoid space. Subarachnoid extension of the lesion was confirmed at surgery. We suggested that this finding of a dural waist on the aneurysm dome was a predictor of such extension. This current report describes another cavernous carotid aneurysm with the angiographic appearance of a waist that was found at surgery to have subarachnoid extension.

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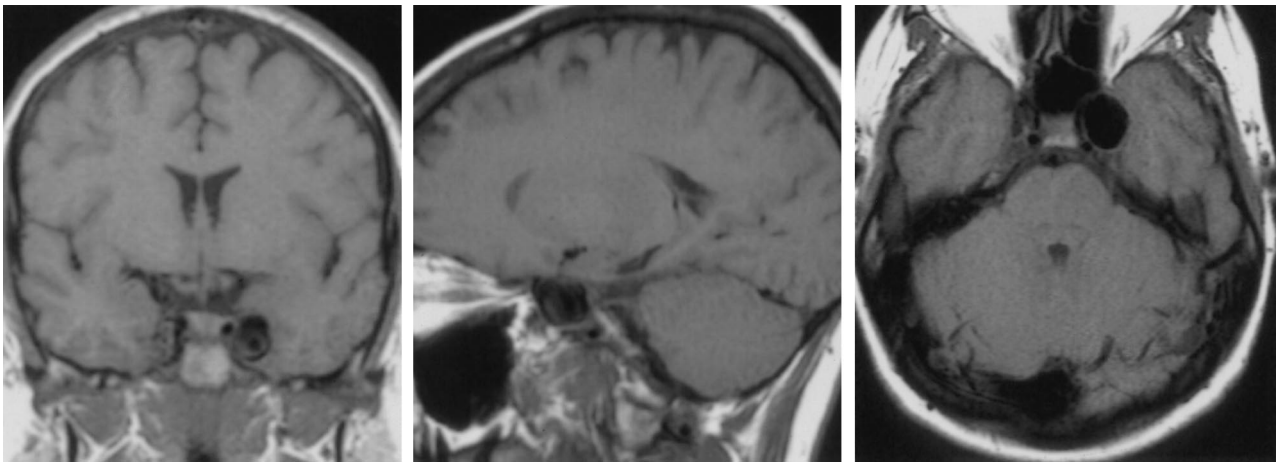
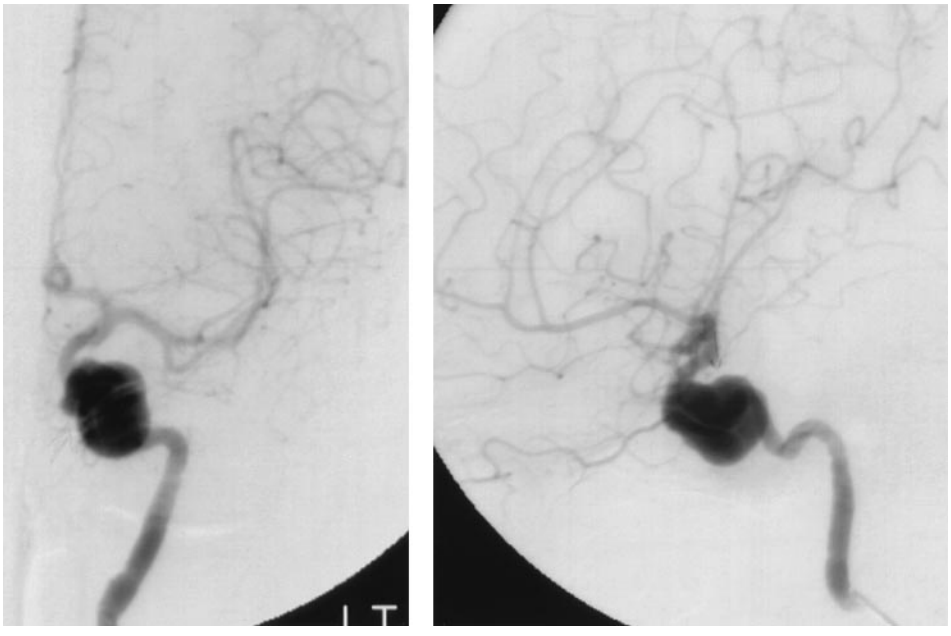


1 Coronal, sagittal, and axial T1-weighted MRI images showing a left intracavernous carotid aneurysm.

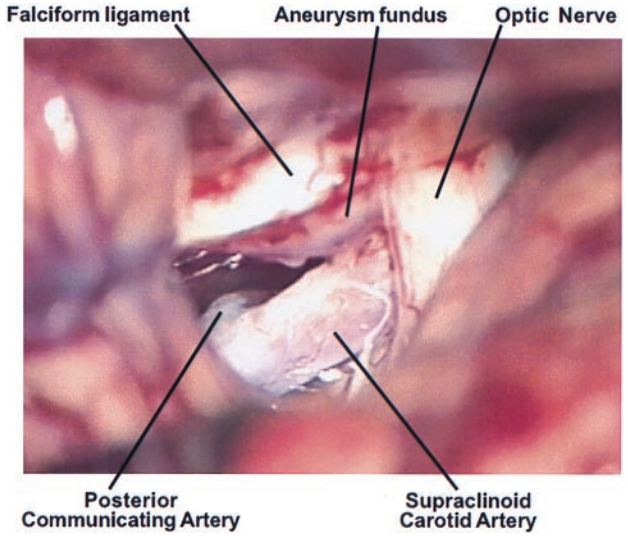
Case Report

A 40-year-old right-handed woman had a 3-month history of bitemporal headache and diplopia. An MRI scan showed a vascular lesion in the vicinity of the left cavernous sinus (Figure 1). On examination a left sixth nerve palsy was detected. An arteriogram demonstrated a large, wide necked, laterally projecting, left cavernous carotid aneurysm (Figure 2). The aneurysm's fundus was indented, creating a waist on the dome. Because of the headache, cranial nerve palsy, and the radiographic appearance of the aneurysm, the lesion was treated.

The patient first underwent a trial balloon occlusion of the carotid artery. Hemispheric perfusion was evaluated using technetium-99 single photon emission computed tomography (SPECT). The patient demonstrated no neurologic deficits during the occlusion period and symmetric perfusion was seen on the SPECT scan. It was therefore predicted that the patient would tolerate permanent trapping with the ICA occluded in the neck and proximal to the left ophthalmic artery. Poor angiographic demonstration of the ophthalmic artery (OA) origin would have made endovascular obliteration difficult, so the decision was made to treat the aneu-



2 AP and lateral left internal carotid injection angiogram showing a proximal internal carotid aneurysm. The dome of the aneurysm is indented along its dorsomedial aspect.



3 Intraoperative photograph showing the aneurysm fundus protruding below the falciform ligament into the subarachnoid space.

rysm by open trapping with planned cervical carotid ligation and clip occlusion of the supraclinoid ICA proximal to the OA.

The patient was brought to the operating room where she underwent a left cervical carotid exposure and a left pterional craniotomy. Upon opening the optic and carotid cisterns, a portion of the aneurysm fundus could be seen extending beyond the falciform ligament (Figure 3). The supraclinoid carotid was dissected and the falciform ligament divided. On inspection the aneurysm neck was clearly seen to protrude into the subarachnoid space and incorporate the carotid artery distal to the OA origin. The internal carotid was then ligated and divided in the neck and clipped intracranially proximal to the posterior communicating artery origin. Postoperative course was unremarkable, although the patient's sixth nerve palsy has not yet resolved.

Discussion

Cavernous carotid aneurysms account for approximately 4% of intracranial aneurysms and usually present with retro-orbital headache, ocular nerve palsies, facial pain, or vision loss. Less commonly they can present with rupture, producing carotid-cavernous fistula, epistaxis, or rarely subarachnoid hemorrhage. The rate of subarachnoid hemorrhage for these lesions has been estimated as 1.4% to 11% [1,3,4]. The discrepancy may relate to the inclusion criteria of a given study for a cavernous aneurysm. Studies that exclude lesions of the anterior genu proximal to the ophalmic artery have lower hemorrhage rates than studies that include all lesions up to the ophthalmic artery. This is presumably because some of these more distal lesions lie in the carotid cave, which is within the subarachnoid space, and therefore are more likely to present with subarachnoid hemorrhage. Part of the difficulty is that the true point of origin of these lesions is often obscured and only later identified at the time of surgery.

This case report is a follow-up to a previous, similar case in which a cavernous carotid aneurysm had the angiographic feature of a narrowing and then widening of the dome, creating a waist in the aneurysm dome. In both of these cases surgical exploration confirmed subarachnoid extension of the aneurysm. It is hypothesized that the waist is created as the aneurysm dome enters the subarachnoid space past the falciform ligament and that this waisting may be a useful angiographic sign of subarachnoid extension. The presence of a second lesion with similar findings strengthens the original observation. Developing CT, MRI, and angiographic clues to subarachnoid extension may help predict which cavernous aneurysms will fail to live up to their benign reputations.

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Commentary

Although the possibility of intradural extension of cavernous aneurysms is well known, it is worth noting these two cases because it is always a difficult call to make. It may be safer to trap these aneurysms surgically rather than permanently occluding the ICA proximal to the aneurysm with detachable balloons. Whenever the neck of the aneurysm straddles the origin of the ophthalmic

artery, there is a risk of incomplete thrombosis of the aneurysm and therefore a risk of subarachnoid hemorrhage.

I always watch my patients carefully after permanent occlusion of the ICA with balloons, and if I see that the ophthalmic artery retrogradely fills the intradural portion of the aneurysm, I submit the case to my neurosurgical colleagues for intradural ligation of the ICA distal to the ophthalmic artery.

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Medical researchers and geneticists played the central roles in the health revolution. . . . Researchers completed mapping the location and purpose of each gene in 2003. Now, they are working to derive the chemistry of each gene and understand the biochemical pathways involved.

But increasingly, medicine has stepped aside. Information has empowered people to make many of their own choices about health. Lifestyle choices and self-care mean health is decentralized. Individuals control their own health. Genetic testing and counseling allow people to make realistic lifestyle choices according to their predispositions to disease if they choose.

—Joseph Coates, John Mahaffie, and Andy Hines
"2025: Scenarios of US and Global Society Reshaped by Science and Technology" (1997)