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Case Report

Bilobulated paraclinoid aneurysm mimics double aneurysms: A comparison of endovascular coiling and surgical clipping treatments

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Abstract

This report presents two cases of subarachnoid hemorrhage caused by rupture of paraclinoid aneurysms. Both aneurysms presented a bilobulated appearance upon image study. Both cases were treated successfully, the first with surgical clipping and the second with endovascular coiling. The special bilobulated feature of paraclinoid aneurysm in this particular anatomic location suggests its close relationship with the carotid dural ring. This relationship caused varying degrees of difficulty in both coiling and clipping the aneurysm. We compared the limitations and advantages of both treatments, and suggest that surgical clipping may be the treatment of choice in this region.

Keywords: carotid dural ring; clipping; coiling; paraclinoid aneurysm

1. Introduction

The treatment of paraclinoid aneurysms has been discussed in many previous articles.[1−8] These aneurysms are defined as those arising from the internal carotid artery (ICA) between the cavernous sinus and the posterior communicating artery. Paraclinoid aneurysms can be located intra- or extradurally, depending on their anatomical relationship with the dural ring. There have also been reports that some aneurysms can be tied by the dural ring, have both intra- and extradural compartments, and look bilobulated.[3,9] Treatment strategies may differ depending on the location and size of the aneurysms, and the physician's personal experience.

Hereby, we present two cases of paraclinoid aneurysms with bilobulated appearance mimicking double aneurysms. One case was treated by coil embolization and the other by microsurgical clipping.

2. Case Reports

2.1. Case 1

A 43-year-old woman suffered from sudden-onset headache, dizziness, nausea, and vomiting. She proceeded to visit a neurological clinic, and underwent magnetic resonance imaging and then digital subtraction angiography (DSA) studies. Both revealed a bilobulated aneurysm at the right distal cavernous and paraophthalmic ICA, approximately 3.8 mm in diameter and 4 mm in neck width. The aneurysm protruded laterally (Fig. 1).

Conflicts of interest: The authors declare that there are no conflicts of interest related to the subject matter or materials discussed in this article.

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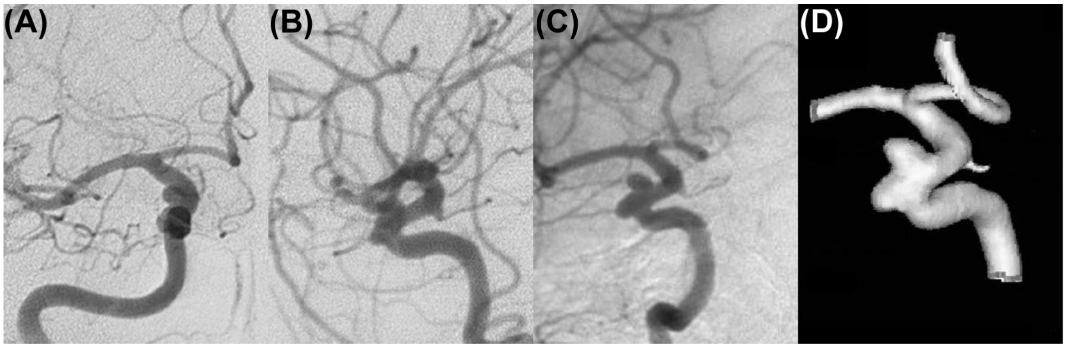

Fig. 1. (A) Anteroposterior view, (B) lateral view, (C) oblique view, and (D) three-dimensional reconstruction of the right internal carotid angiogram shows a bilobulated aneurysm protruding laterally.

The patient underwent craniotomy for aneurysm clipping 2 months after the episode. During the operation we found a wide-neck aneurysm near the takeoff of the ophthalmic artery from the right ICA. The dome size and neck size were about 7 mm × 4 mm and 6 mm, respectively. The aneurysm was divided by the distal dural ring into two lobules. After the release of the dural ring, a curved aneurysm clip was used to clip the neck of the aneurysm without temporary clipping Fig. 2).

The patient recovered well after the surgery and was discharged without neurological deficit. The follow-up computed tomography (CT) angiography, which was performed 8 days after the surgery, showed no residual aneurysm, and all relevant major arteries were preserved.

2.2. Case 2

A 63-year-old woman, who suffered from sudden-onset headache and dizziness during work, was sent to the hospital for medical management. She had a history of hypertension, which had been under good medical control for several years. Her consciousness remained clear at the time of admission. The DSA disclosed a bilobulated aneurysm in the left ICA, involving the distal cavernous and supraclinoid segments. The aneurysm had a wide neck with two domes protruding posteriorly and medially, forming two compartments. The larger distal compartment was about 6.5 mm in length, and the smaller proximal compartment had a dome of 2.2 mm (Fig. 3).

The patient later underwent endovascular embolization therapy. Transfemoral embolization of the wide-neck aneurysm was performed by stent-assisted coil embolization. A 4.5 mm × 20 mm self-expandable stent (Neuroform 2; Boston Scientific Corp., Fremont, CA, USA) was deployed into the ICA to bridge the aneurysm neck, followed by navigation of a microcatheter into the aneurysm sac of the ICA. Seven electrodetachable coils (Boston Scientific Corp.) were inserted into this sac. Postembolization DSA revealed total obliteration of the aneurysm sac without compromise of the parent artery. However, the smaller proximal compartment is difficult to access due to the vascular and aneurysmal anatomy.

This patient tolerated the whole embolization procedure well and was discharged in a stable condition. The follow-up CT angiography performed 4 months later disclosed total angiographic occlusion of the aneurysm sac, with no evidence

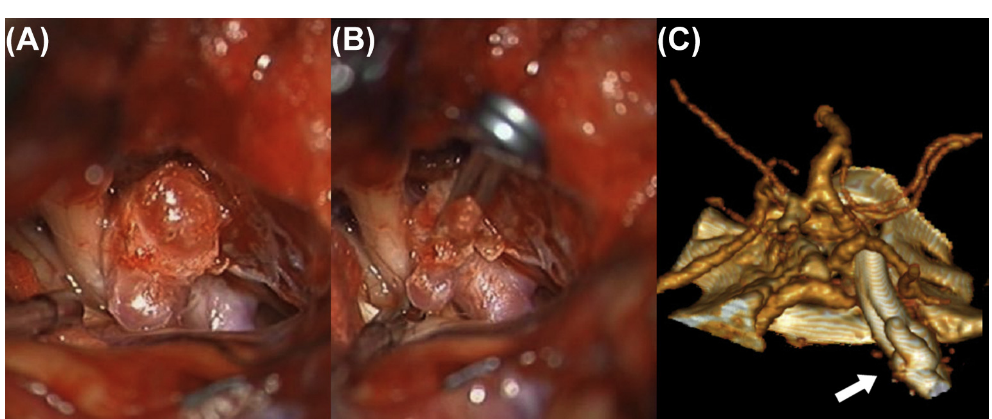

Fig. 2. After removal of the anterior clinoid process extradurally, the clinoid segment of the internal carotid artery is exposed. A bilobulated aneurysm is (A) seen and (B) clipped under a microscope. (C) Reconstruction of postoperative computed tomography angiography shows a clip (arrow) beside the internal carotid artery without residual aneurysm.

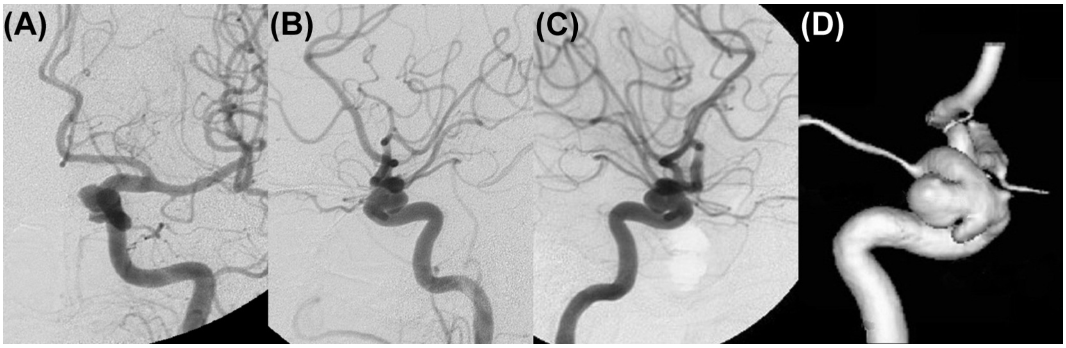

Fig. 3. (A) Anteroposterior view, (B) lateral view, (C) oblique view, and (D) three-dimensional reconstruction of the left internal carotid angiogram shows a bilobulated aneurysm at the left distal cavernous and paraophthalmic internal carotid artery. The aneurysm protruded posteriorly and medially.

of coil compaction or recurrent aneurysm sac. However, the small part of the aneurysm at the left distal cavernous ICA remained (Fig. 4).

3. Discussion

The pattern of paraclinoid aneurysms varies depending on the following factors: from which part of the ICA they originate, the dome protruding direction and also their relationship with cavernous sinus, dural ring, anterior clinoid process, ophthalmic artery, and superior hypophyseal artery. Owing to the different conformations of aneurysms, the treatment of paraclinoid aneurysms should be individualized, which is challenging to both neurosurgeons and interventional neuroradiologists.[3,5,9,10] Al-Rodhan et al[11] classified paraclinoid aneurysms into five different groups. They termed the rare cavernous aneurysms as "transitional cavernous aneurysms" if they were large, with their necks arising from the cavernous segment of the ICA and their dome projecting superiorly into the intradural subarachnoid space. These aneurysms had both extra- and intradural compartments, and can be definitively diagnosed intraoperatively. However, they were difficult to define in preoperative medical imaging. Hashimoto et al[12] carried out image studies using different anatomic markers, such as optic strut that can be identified on CT scans, to discriminate between the intra- and extradural planes. Another study also tried to locate the distal dural ring plane on magnetic resonance imaging study.[13] However, identifying a dural ring on neuroimaging and defining its relationship with the aneurysm are difficult using the current imaging techniques. Accordingly, the two bilobulated aneurysms discussed in this report were "transitional cavernous aneurysms", and the first case was confirmed by surgery. The bilobulated appearance of a paraclinoid aneurysm, as observed on neuroimaging, may be a reliable sign, indicating that the aneurysm was tied by a dural ring. This sign can be valuable in helping clinicians make reasonable decisions regarding different treatment strategies, such as coiling and clipping.

In the case treated by clipping, we took the pterional approach. After the anterior clinoid process was removed, sinus bleeding was controlled by injecting tissue glue into the cavernous sinus extradurally. Thereafter, the clinoid segment and cavernous part of ICA were fully exposed. Meticulous dissection of the dural ring exposed the neck of the aneurysm. Afterward, the relevant dural matter was opened and the intradural part of the aneurysm was dissected. An aneurysm

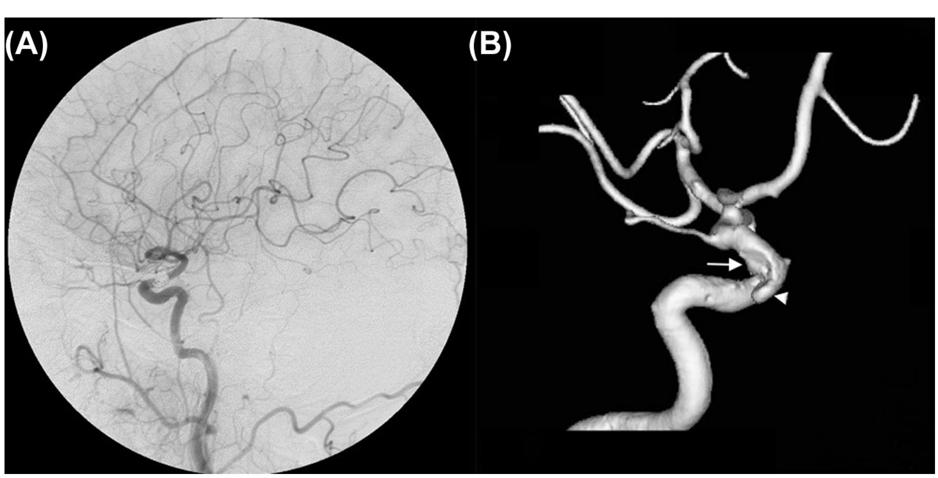

Fig. 4. (A) Lateral view and (B) three-dimensional reconstruction of the left internal carotid angiogram that was performed after embolization. The larger distal compartment of this aneurysm is embolized with coils (arrow), but the smaller proximal compartment is residual (arrowhead).

clip was safely applied after the aneurysm was fully exposed. During this procedure, drilling of the anterior clinoid process was crucial to create the angle necessary for further dissection. This procedure may involve the risk of causing catastrophic rupture of the aneurysm, especially when the aneurysm dome protruded superiorly and laterally. According to the post-therapeutic DSA of Case 2, we found that embolization was inherently limited in dealing with both lobules of the aneurysm. This was primarily due to the tortuous vascular anatomy in the paraclinoid ICA and complicated aneurysm anatomy. Furthermore, both of our bilobulated paraclinoid aneurysms had wide necks. Based on the current clinical practice, stent-assisted coil embolization should be mandatory if coiling treatment was undertaken. However, navigating the microcatheter into the aneurysm sac through the stent mesh is associated with a high failure rate. The aforementioned difficulty may result in leaving one lobule of the aneurysm, in particular the proximal lobule, untreated, as in Case 2.

Although complete coiling of this type of aneurysm is usually unfeasible, whether the extradural lobule of the aneurysm needed to be occluded remains controversial. Clinically, if only the extradural part of the aneurysm is left, the risk of subarachnoid hemorrhage will be low. This low subarachnoid hemorrhage risk justifies coiling of only the intradural lobule of the bilobulated paraclinoid aneurysm, while leaving the extradural lobule intact followed by long-term postsurgical observation.

In conclusion, the bilobulated appearance of a paraclinoid aneurysm is a reliable sign indicating that the aneurysm straddles both intra- and extradural spaces. Although surgical clipping is invasive and is highly skill dependent for this particular type of aneurysm, by taking into account the complexity of neuroanatomy and the constraints of coiling both lobules of the aneurysm, surgical clipping remains the treatment of choice for bilobulated paraclinoid aneurysms.

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