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Case Report

Surgical treatment of a giant paraophthalmic aneurysm postfailed flow diversion through endoscopic endonasal approach: Technical nuances and review of the literature

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ABSTRACT

Background: Giant internal carotid artery (ICA) aneurysms are usually treated through flow diversion, coiling, or a combination of both. However, certain cases that fail the endovascular treatment pose a technical challenge.

Case Description: A 68-year-old male presented with gradual visual changes affecting his right eye and was found to have a giant unruptured right paraophthalmic aneurysm. The aneurysm showed growth, and the patient's symptoms worsened despite coiling and flow diversion. Due to the location of this aneurysm and persistent compression of the optic chiasm by the coil mass, his right ICA was sacrificed, and an expanded endoscopic endonasal approach was successfully used to clip the residual aneurysm, remove the coil mass, and thus, decompress the optic chiasm. The patient's visual symptoms improved after that, and post clipping imaging demonstrated adequate occlusion of his right paraophthalmic aneurysm.

Conclusion: Recognizing the option of an endoscopic endonasal approach for clipping giant internal carotid aneurysms is of great importance. This approach can be safe and technically successful for the treatment of paraophthalmic aneurysms that fail the typical endovascular treatment.

Keywords: Aneurysm, Clipping, Endonasal, Endoscopic, Paraophthalmic

INTRODUCTION

Paraophthalmic aneurysms characteristically arise from the internal carotid artery (ICA) and clinically present with various visual deficits ranging in severity. These include aneurysm rupture with subarachnoid hemorrhage, and nonspecific symptoms such as headache, tinnitus, vertigo, transient ischemic attacks, or otherwise are incidentally discovered. In addition, these aneurysms pose technical challenges due to their proximity to critical intracranial structures.[10]

The current treatment options include coil embolization, flow diversion, surgical clipping, or a combination of these treatment modalities. The majority are commonly treated through an endovascular approach that typically involves the placement of a flow diverter stent. However, endovascular treatment with flow diversion is not without risk and may not completely occlude giant aneurysms presenting with cranial neuropathies such as ophthalmologic symptoms. In these cases, surgical clipping remains an option.[2,6,7]

In this operative report, we present a case of a 68-year-old male with a giant unruptured right paraophthalmic artery aneurysm presenting with visual symptoms. After initial coiling and flow diversion, the aneurysm showed growth, and the patient's visual symptoms worsened. An expanded endoscopic endonasal transsphenoidal approach was successfully used to clip the residual aneurysm and decompress the coil mass and the optic chiasm, improving the patient's symptoms and preventing further visual loss.

CASE REPORT

A 68-year-old male with a history of hypertension presented with a 1-year history of gradually decreasing right eye visual acuity with occasional headaches. His examination was nonfocal except for decreased visual acuity in the right eye without papilledema. Magnetic resonance imaging was initially ordered and demonstrated a giant right paraophthalmic aneurysm [Figure 1a]. Digital subtraction angiography (DSA) further characterized it as a medially and superiorly projecting giant right paraophthalmic aneurysm just distal to the ophthalmic artery, measuring 2.1 by 1.4 cm with an 8-mm neck [Figure 1b]. After informed consent was obtained, the patient's aneurysm was successfully coiled and flow diverted with one surpass evolve stent (Stryker Neurovascular, Fremont, California) [Figures 2a and b]. The patient was maintained on dual antiplatelet therapy after that. About two months after his initial treatment, the patient's right eye's visual acuity declined, and he also developed a new left visual deficit. He was started on a course of steroids in hopes of alleviating his symptoms from the optic chiasm compression and optic nerve inflammation. A follow-up DSA revealed a residual paraophthalmic aneurysm and balloon test occlusion of his right ICA was successfully performed, with the patient tolerating it without any deficits due to the presence of a large anterior communicating artery. The patient became increasingly more symptomatic despite steroids, with now complete loss of vision in his right eye. The decision was made to sacrifice the right ICA with plans for definitive treatment through surgical clipping and possible decompression of the optic chiasm to preserve what is left of his left visual acuity [Figures 3a and b].

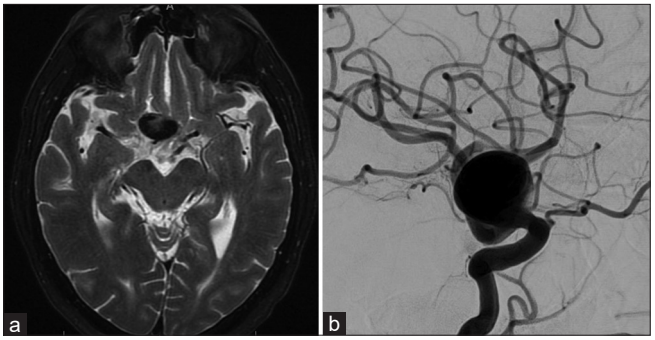

Figure 1: (a) Initial magnetic resonance imaging and (b) digital subtraction angiography demonstrated medially and superiorly projecting the right paraophthalmic aneurysm coming off just distal to the ophthalmic artery, compressing the optic chiasm.

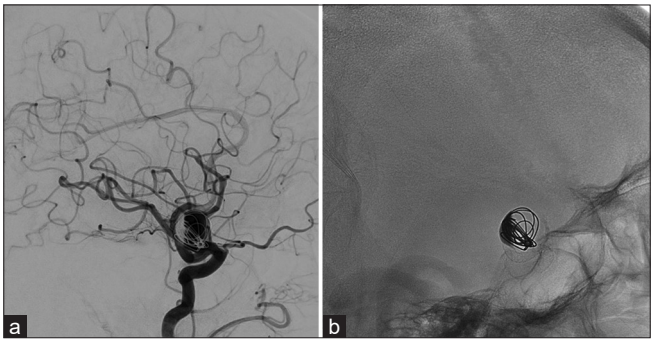

Figure 2: (a) Subtracted and (b) non-subtracted view of lateral right internal carotid artery injection demonstrating adequate coiling and placement of surpassing flow diverting stent across the paraophthalmic aneurysm with resultant stagnation of contrast.

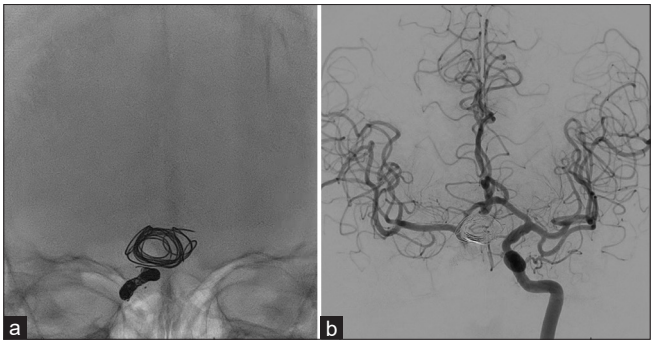

Figure 3: (a) AP non-subtracted view and (b) subtracted view of left internal carotid artery (ICA) injection demonstrating successful sacrifice of right ICA with coils and filling from the left ICA injection.

Operative technique

After his right ICA sacrifice, there was no residual filling of the aneurysm or the right ICA beyond the communicating segment from the contralateral side through the anterior communicating artery complex. The patient underwent an expanded endoscopic endonasal approach for clipping and resection of his right paraophthalmic aneurysm [Figures 4a-f]. After the sphenoid was opened, the sella, tuberculum sella, and planum were drilled off to expose bilateral optic nerves. The dura was opened widely to expose bilateral ICAs. It was observed that the giant right paraophthalmic aneurysm severely compressed the right optic nerve and the chiasm. After confirming no flow through the aneurysm with a Doppler, the aneurysm was carefully opened with a featherblade knife, and coils were slowly evacuated. With this maneuver, the aneurysm gradually softened, and the neck of the aneurysm was then dissected out and clipped with a single straight clip. The aneurysm

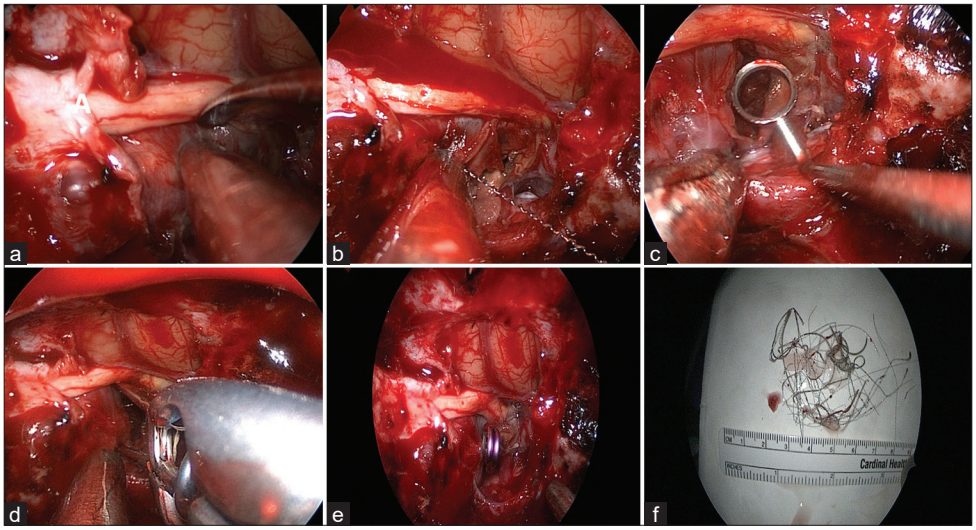

Figure 4: Intraoperative photographs of (a) compression of the right optic nerve and chiasm by a giant aneurysm, (b) evacuation of its coils, (c) further evacuation of its contents with a ring curette, (d) clipping of the aneurysm, (e) final position of the straight clip and resultant decompression of the optic apparatus, and (f) evacuated coils and clot from the previously coiled aneurysm mass.

was additionally decompressed by removing more coils until the optic apparatus was adequately decompressed. The skull base was repaired with DuraGen, and the nasoseptal flap was laid on the bony defect and its surrounding edges were lined with SURGICEL and DuraSeal glue. The patient's immediate postoperative course was uneventful. However, his right eye did not regain the lost vision; his left visual acuity and field testing both improved after the surgery. He is no longer symptomatic and has recovered well. A follow-up computed tomography angiography demonstrated expected postsurgical changes and no further recurrence of the aneurysm.

DISCUSSION

The majority of giant paraophthalmic aneurysms are commonly treated through coil embolization with or without stenting or flow diversion. Complications of flow diverters may include stent migration and ophthalmic complications such as optic perineuritis. The other limitation of the endovascular approach to these aneurysms is that the stent/coil approach may result in incomplete occlusion of the aneurysm and the subsequent need for retreatment. Another treatment modality for giant paraophthalmic and ophthalmic aneurysms is surgical clipping. However, this approach may result in mixed outcomes with visual acuity recovery on a wide spectrum. The variability in outcomes may be attributed to the degree of aneurysm calcification, size, thrombosis, and other patient-specific demographics and co-morbidities.

Here, we reported a case of a giant unruptured right paraophthalmic artery aneurysm that failed endovascular treatment and was successfully clipped with optic chiasm decompression through an expanded endoscopic endonasal approach. The endoscopic endonasal approach is routinely implemented to excise pituitary neoplasms but also serves as an uncommon surgical option for clipping aneurysms coming off ICA and its paraclinoid branches. From conducting a literature review, we found only a few reports describing the use of this technique.[2,6-9] One reason for this may be due to technical feasibility. As noted by Bao *et al.*, this approach may be more operatively challenging for laterally oriented lesions rather than medially oriented lesions.[2] However, given the medial orientation of this patient's aneurysm, we thought that this approach demonstrated viability with more benefits than risks. Notably, literature comparing specific outcomes of paraophthalmic aneurysms based on treatment modality is also scarce. For example, Falk Delgado *et al.* observed no marked differences in clinical outcomes between endovascular coiling and surgical clipping for surgical intervention of ruptured ophthalmic artery aneurysms.[5] However, Silva *et al.* reported that flow diversion was more effective in visual improvement than clipping or coiling for the treatment of paraclinoid aneurysms.[10] Several studies have demonstrated favorable clinical outcomes for patients with ICA aneurysms presenting with cranial neuropathies treated with flow diversion. However, many have found that this treatment has to be initiated early after symptom onset to achieve improvement in symptoms.[1,3,4] In our case, a year had passed before the patient sought initial treatment. Whether the resolution of his visual symptoms would have occurred after surgical clipping alone remains unknown.

CONCLUSION

Giant paraophthalmic artery aneurysms typically present with various ophthalmologic disturbances. Management consists of endovascular embolization through flow diversion and/or coiling, as well as less common surgical clipping. The endoscopic endonasal transsphenoidal approach for clipping such aneurysms has been minimally reported in the literature but remains a feasible option. Through the illustrative case presented here, we have demonstrated the technical nuances of surgical clipping of a giant paraophthalmic aneurysm through an endoscopic endonasal approach after endovascular treatment has failed.

Ethical approval

Institutional Review Board approval is not required.

Declaration of patient consent

Patient's consent not required as patient's identity is not disclosed or compromised.

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Nil.

Conflicts of interest

There are no conflicts of interest.

Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of artificial intelligence (AI)-assisted technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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