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Endoscopic endonasal approach for simultaneously treating a pituitary adenoma coexisting with a paraclinoid aneurysm: illustrative case

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BACKGROUND There is a certain incidence of pituitary adenomas coexisting with intracranial aneurysms, but a concurrent therapeutic strategy of tumor removal and aneurysm clipping via endoscopic endonasal approach is rarely reported. The indications and limitations of endoscopic endonasal approach surgery for this type of lesions are worth discussing.

OBSERVATIONS The case of a pituitary tumor coexisting with a paraclinoid aneurysm was reviewed. Using an endoscopic endonasal approach, the pituitary adenoma was completely excised with extrapseudocapsular separation technique, the aneurysm was clipped at the same time, and the skull base defect was reconstructed in multilayer fashion. No tumor recurrence was found, and aneurysm clipping was complete at the 6-month follow-up after surgery.

LESSONS For patients harboring a pituitary adenoma with a selected paraclinoid aneurysm, simultaneous tumor resection and aneurysm clipping via endoscopic endonasal approach are feasible. This strategy has the advantages of saving medical resources, promoting the patient's rapid postoperative recovery, and reducing possible antiplatelet therapy after interventional therapy. However, surgery needs to strictly follow the indications in experienced hands, and the therapeutic effect needs to be verified by more cases and longer follow-up results.

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KEYWORDS endoscopic endonasal approach; pituitary adenoma; paraclinoid aneurysm

It is not uncommon to detect unruptured aneurysms in preoperative examination of pituitary tumors, among which paraclinoid aneurysms account for a large proportion.[1,2] There are many therapeutic strategies for such tumors appearing concurrent with aneurysms. The staging plan is mainly to remove pituitary adenoma after interventional aneurysm treatment. The concurrent strategy includes craniotomy for aneurysm clipping combined with pituitary adenoma removal, craniotomy for aneurysm clipping and transsphenoidal surgery for pituitary adenoma removal, and endoscopic endonasal surgery for simultaneous tumor resection and aneurysm clipping.[3] A minimally invasive method with low cost and subsequent no-drug treatment for patients is the best, and the most consistent with this principle is the endoscopic endonasal approach for simultaneous removal of pituitary adenoma and clipping of aneurysm. There were few reports about the concurrent surgical strategy.[4] The indications, operation details, and safety and efficacy of this method are worth discussing.

Illustrative Case

A 51-year-old woman was admitted with the chief report of vision loss for 2 years and headache for 2 months. Preoperative evaluation found mild visual loss (20/25 in the left eye and 20/20 in the right eye) with temporal hemianopsia in the left eye. Endocrine examination showed normal pituitary function. Cranial nerve test also found no abnormalities. Preoperative magnetic resonance imaging (MRI) showed a sellar mass with heterogeneous enhancement

ABBREVIATIONS DSA = digital subtraction angiography; ICA = internal carotid artery; MRI = magnetic resonance imaging.
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2.2 × 2.5 cm and a lesion suspicious for an aneurysm. Digital subtraction angiography (DSA) confirmed a paraclinoid aneurysm measuring 3.5 mm in the neck and 2.2 mm in the body, with the dome pointing medially and inferiorly. After comprehensive consideration of the patient's economic situation, acceptance of craniotomy, postoperative treatment compliance, and the characteristics of the lesion itself, we recommended the endoscopic endonasal approach for simultaneous resection of the tumor and clipping of the aneurysm.

Operative Technique

After inducing general anesthesia and preparing navigation, the patient was placed supine with the vertex of the head moved slightly to the left and face slightly turned to the right. The head was fixed with a three-pin holder. Surgical exposure for pituitary adenoma, using a 0°, 18 cm × 4 mm rigid endoscope (Karl Storz), was performed as described before. The neuronavigation (Excelim-04 Image Guide System, Fudan Digital Medical Co.) was used when necessary. A pedicle nasoseptal flap on the right side was harvested and stored in the nasopharynx in routine fashion. After routinely opening the sellar floor for pituitary adenoma surgery, the bone of the internal carotid artery (ICA) protuberance on the left side was removed totally for clearly exposing the paraclival ICA. The next key step was removing the lingual process of sphenoid bone and flattening the bone around the petroclival fissure, which made room for proximal ICA control for the clipping. The bone window was extended to the tuberculum sellae, and the superior intercavernous sinus was exposed. The sellar dura was cut in a cruciate manner, the boundary between tumor and normal gland was found on the right, and the dissection continued in the extrapseudocapsular space from right to left and from bottom to top. The tumor texture was soft, so the pseudocapsular was not kept intact. The dome of aneurysm was recognized in the upper left corner with reddish appearance, so dissection and aspiration was performed gently and meticulously. The normal gland was mainly positioned in upper right side in this patient. The next step involved coagulating and cutting the superior intercavernous sinus and opening the suprasellar dura. Prior to entering the subarachnoid space to expose the aneurysm neck, the paraclival ICA was controlled with a temporal clip (a straight FT 260 T Yasargil clip). Then the optic nerve, superior hypophysial arteries, and ophthalmic artery were exposed to find the aneurysm. The supraclinoid segment of ICA was exposed for distal control. The dura covering the dome of the aneurysm was not cut. A straight FT 710 T Yasargil clip was applied using Yasargil pistol-grip applying forceps (B. Braun, Aesculap) to clip the aneurysm, and the distal end of the blade was seen clearly without any additional trapping. The left optic nerve, superior hypophysial arteries, and ophthalmic artery were intact. The temporal clip was removed and venous bleeding handled with Surgiflo. Multilayer reconstruction was completed with fat harvested from the right thigh, Duragen, fascia lata, and nasoseptal flap layer by layer. After surgery, fibrin sealant was placed around the nasoseptal flap. The sphenoid sinus was filled with iodoform gauze. The patient had an uneventful recovery and was discharged a week after surgery. The postoperative MRI showed total tumor removal, and computed tomography angiography demonstrated complete occlusion without any aneurysm neck residue and parent artery stenosis. No endocrine replacement therapy was required (Figs. 1 and 2; Video 1).

VIDEO 1. Clip showing surgical procedure. Click here to view.

Discussion

Observations

Endoscopic endonasal clipping of intercranial aneurysms, which has been shown to be feasible in many anatomical studies and clinical applications,[5–14] is not the principal strategy of the aneurysm-clipping surgery. Meanwhile, among the reports of planned endoscopic endonasal clipping surgery, paraclinoid aneurysm accounted

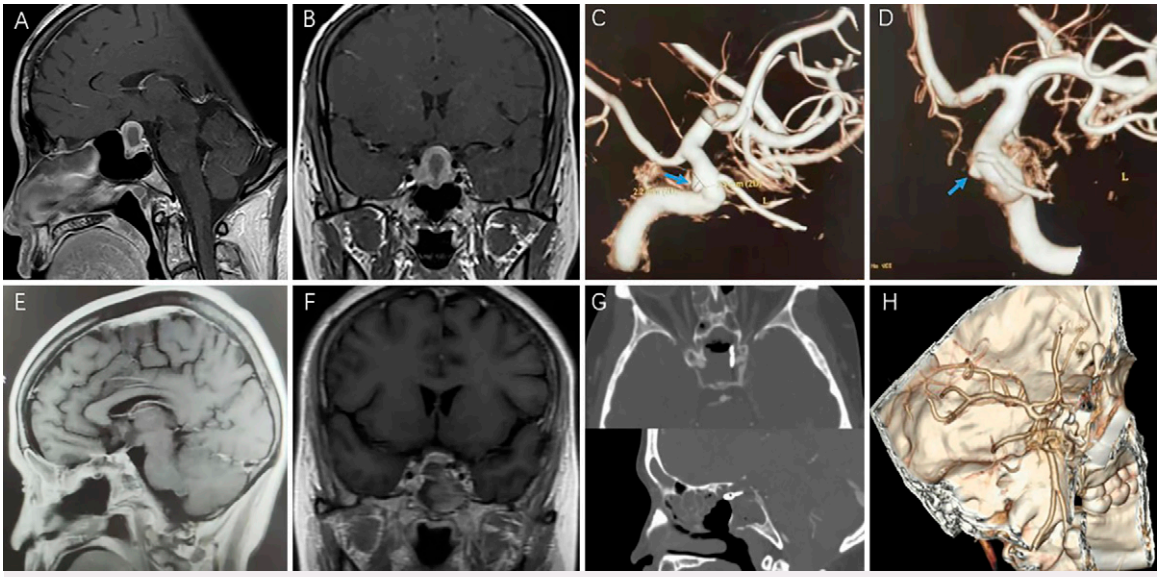

FIG. 1. Preoperative MRI (**A and B**) showed a sellar mass with heterogeneous enhancement 2.2 × 2.5 cm. Preoperative DSA (**C and D**) confirmed a paraclinoid aneurysm measuring 3.5 mm in neck and 2.2 mm in body, with the dome pointed medially and inferiorly. The *arrows* indicate the location of the aneurysm. Postoperative MRI (**E and F**) demonstrated total tumor removal. Postoperative computed tomography angiography (**G and H**) demonstrated total aneurysm clipping without parent vessel stenosis.

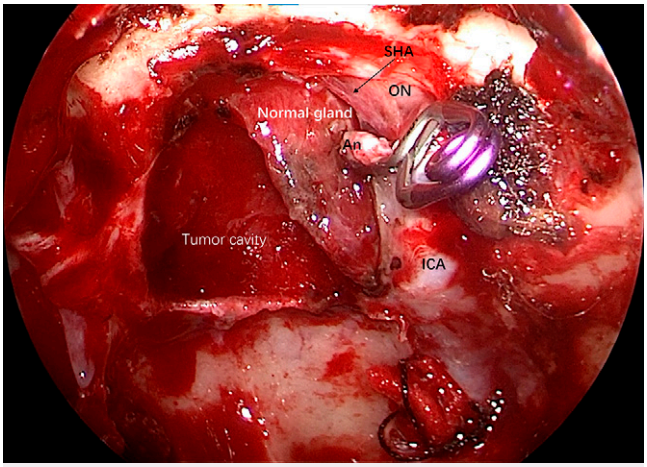

FIG. 2. Intraoperative view after tumor removal and aneurysm clipping. An = aneurysm; ON = optic nerve; SHA = superior hypophyseal artery.

for most.[6,9] Nowadays, endovascular surgery is developing rapidly in the treatment of paraclinoid aneurysms, most of which are treated by interventional therapy, but it is expensive and requires long-term antiplatelet therapy after the operation. A small number of patients who are not suited for endovascular surgery or cannot afford it choose transcranial clipping. Surgical corridors include ipsilateral and contralateral approaches. Ipsilateral approaches require complex manipulations such as exposing the cervical ICA and removing the anterior clinoid process, whereas contralateral approaches have poor control over the proximal end of the parent artery. Paraclinoid aneurysms are always a challenge for microsurgical clipping. With the advantages of a panoramic view of aneurysm, direct route to the aneurysm and parent artery, avoidance of brain retraction, better cosmetic effect, and easy proximal control of the ICA, endoscopic endonasal clipping has been reported as an alternative approach for clipping paraclinoid aneurysms.

The previous reports were mainly pure aneurysm clipping without combined lesions. In the present case, the interaction effects between pituitary adenoma and paraclinoid aneurysm should be comprehensively contemplated. Considering the effect caused by aneurysm to pituitary adenoma, the paraclinoid aneurysm contacted the pituitary tumor but did not occupy the route to expose the tumor, so securing the aneurysm should be done prior to resecting tumor to prevent intraoperative rupture. We achieved satisfactory space for proximal control after removing the bone embracing the paraclival ICA and rehearsing temporary trapping. Removal of the lingual process and petrous process of the sphenoid bone was the crucial step for acquiring adequate room for temporary occlusion. Generally, in larger medial carotid aneurysms, the best segment of the carotid for proximal occlusion was thought to be the cavernous segment, while opening the cavernous sinus may cause massive venous bleeding. We took the extracavernous segment of ICA as the occlusive site, which was helpful for reducing bleeding from the cavernous sinus. The branches of the trigeminal nerve, gasserian ganglion, abducens nerve, and ICA were not in danger if the dura posterior to lingual process and petroclival fissure were kept intact, as cautioned in anatomical study.[5] In the case of pituitary adenomas invading the cavernous sinus, the extradural paraclival ICA exposure cannot be omitted because using the cavernous segment of ICA as the site of proximal occlusion may result in cranial nerve injury, and this site can only be exposed after resection of most of the tumor, which is not a good option for preventing aneurysm rupture during surgery.

Considering the effect caused by pituitary adenoma to aneurysm, the endoscopic endonasal clipping may require pituitary gland transposition in the absence of pituitary adenoma, which is also a complex procedure, but in combined tumor surgery, removal of the tumor provides room for clipping the aneurysm as needed. We did not open the dura covering the dome of the aneurysm as described in the first report of endoscopic endonasal clipping of paraclinoid aneurysm by Kassam et al.,[13] because after removing tumor, the dura edge was proper for clipping and further dissection of dura only involved more risk. In summary, exposure of the paraclival ICA, tumor removal, and aneurysm clipping should be completed step by step. At the end of the operation, the clip breached level of base reconstruction in solo tumor resection. The end of the clip was wrapped by multilayer reconstruction performed without cerebrospinal fluid leakage. The principles of aneurysm clipping were also obeyed in endoscopic endonasal clipping: (1) ability to gain proximal and distal control, (2) exposure of vessels and their respective perforators, and (3) possibility of clip placement, as described before.

In reports of a pituitary adenoma coexisting with an aneurysm, the rates have ranged from 2.3% to 8.3%.[1,2,15] Endoscopic endonasal clipping is not suitable for all aneurysms. Medial and inferior projection with not large size are indications for endoscopic endonasal clipping. The limitations of the procedure include difficulty in exposing the neck of aneurysms projecting laterally, difficulty in large aneurysms hindering visualization and control of the aneurysm neck and the distal ICA, and impossibility of bypass. However, ruptured aneurysms are not contraindications.[11,16,17] The most common postoperative complications were cerebrospinal fluid leak, stroke, meningitis, and transient hemiparesis.[7]

The drawbacks in our treatment included MRI of the wall not being performed to assess the likelihood of aneurysm rupture[18] and intraoperative endoscopic fluorescence not being available to confirm whether the clipping was complete and whether the parent artery was unobstructed.

Lessons

The advantages of personalized therapy have been introduced by technological advances. When confronted with pituitary adenoma coincidental with paraclinoid aneurysm, in a team that harbors the experience of the endoscopic endonasal approach and cerebrovascular surgery, owns adequate instruments and equipment, and ensures that patient selection is made with extreme caution, surgery for small, superiorly or medially projecting aneurysms could be best achieved with endoscopic endonasal tumor removal and aneurysm clipping. This strategy has the advantage of saving medical resources, promoting a patient's rapid postoperative recovery, and reducing possible antiplatelet therapy after interventional therapy.

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Disclosures

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author Contributions

Conception and design: He, Gu, Zhong. Acquisition of data: Zhong, Gao. Analysis and interpretation of data: He, Zhong, Gao. Drafting the article: He, Gu. Critically revising the article: He, Gu. Study supervision: He, Gu.

Supplemental Information

Video

Video 1. https://vimeo.com/703303858.

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