A technique for endoscopic pituitary tumor removal


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A number of milestones have marked the development of transsphenoidal pituitary tumor resection this century. The introduction of headlamp illumination, followed by the use of the operating microscope and fluoroscopy have allowed neurosurgeons to perform this surgery in a safe and highly effective manner.

With the aid of a case report, we describe the incorporation of endoscopic techniques in pituitary tumor resection. The technique described is minimally invasive, avoiding septal dissection and allowing unsurpassed, unobstructed, and panoramic visualization of the region of interest to the surgeon and operative team.

Key Words * pituitary * endoscopy * transsphenoidal approach * neoplasm

The sublabial or paranasal transseptal-transsphenoidal approach to the sella turcica and adjacent structures for lesions such as pituitary adenomas has become a standard approach to this region.\[1,22\] The midline approach avoids injury to the internal carotid artery and optic nerve, which may be at risk using a transethmoidal approach. The midline approach avoids the brain retraction associated with intracranial approaches to this region; however there are disadvantages, which include septal and nose structure dissection leading to cosmetic or functional disabilities. This approach can also limit direct visualization of all regions of the sphenoidal sinus and extending it to include the ethmoidal sinuses may be difficult.

Endoscopy is a technology that has gained wide acceptance in most specialties of surgery. In neurosurgery, it is being used widely for surgery of lesions of the ventricles. Its main advantage is that it allows excellent visualization of internal structures while minimizing soft-tissue dissection to expose the pathology of interest. The minimally invasive nature of endoscopy has precipitated its exponential use in surgery. We thought that this technique could be used in dealing with lesions of the sella turcica. The purpose of this paper is to describe our endoscopic technique of pituitary tumor resection and to illustrate it with a case in which we used endoscopy to remove the ethmoidal, sphenoidal, and sellar portions of an extensive pituitary adenoma.

ILLUSTRATIVE CASE

This 29-year-old woman presented with a 6-month history of severe headache superimposed on intermittent headaches for 6 years. She had a 2-month history of visual loss in her right eye, diplopia, and
amenorrhea.

Examination. Examination revealed a right relative afferent pupillary defect with 20/40 visual acuity and mild difficulty moving her jaw to the right. Magnetic resonance imaging revealed a 6- X 5- X 6-cm lesion involving all three cranial fossa, the right cavernous sinus, and the ethmoidal and sphenoidal sinuses.

Operation. After an endoscopic biopsy that revealed an atypical pituitary adenoma, she initially underwent operation via a right orbitozygomatic approach for debulking of the cavernous sinus portion of the tumor.

Postoperative Course. Five days after this surgery and just prior to a planned second-stage operation for resection of residual tumor, she developed a left hemiplegia secondary to severe vasospasm. Aggressive management using calcium channel blocking agents and hypervolemic, hypertensive, hemodilution therapy resulted in improvement of her hemiplegia. Near-complete recovery from the resultant deficits required 3 months. In the interim, because the tumor was found to secrete alpha subunit and show somatostatin receptors on indium-111 octreotide nuclear scanning, she was treated with octreotide, which precipitated a decrease in her serum alpha subunit level from 105.8 ng/ml (normal < 2.5 ng/ml) to 19.9 ng/ml. Clinically she was stable but still had extensive tumor remaining. Rather than risk further vasospasm with potential ischemic injury that might be induced via a transcranial approach, an endoscopic transnasal approach was used to debulk the ethmoidal, sphenoidal, and sellar components of the tumor (Fig. 1). We planned a subtotal resection because the tumor encased the cavernous carotid artery and involved the basilar artery.

![Fig. 1. Sagittal magnetic resonance images before (left) and after (right) debulking of the tumor. The sphenoidal component of the tumor is entirely replaced by fat and fascia lata grafts (arrows).]

DESCRIPTION OF THE OPERATION

After general anesthetic was administered to the patient, we proceeded under fluoroscopic guidance to inject the nasal mucosa of the middle turbinates with a 1:100,000 epinephrine solution to induce vasoconstriction. We placed a guide into the left nostril for easy and rapid insertion and removal of the endoscope. We then resected the middle turbinate using a 0-degree rigid endoscope specially designed for sinus surgery. Under direct visualization, we opened the ethmoidal sinuses and resected the tumor from those regions. We identified tumor at both sphenoidal ostia. We enlarged the ostia with Kerrison...
rongeurs and removed the sphenoidal rostrum and posterior vomer to open the whole anterior wall of the sphenoid sinus. The tumor was easy to resect from this position. We inserted a standard nasal speculum into the right nostril to facilitate the use of standard transsphenoidal dissection instruments. We entered the sella using a combination of microcurettes and microdissectors and removed tumor within and just above the sella. Because the residual tumor abutted the basilar artery, we did not attempt an extensive resection of the suprasellar and retrosellar tumor. We repaired a cerebrospinal fluid (CSF) leak with fibrin glue, fat, and fascia lata packing. We used vaseline-impregnated gauze to pack the nasal cavities (Fig. 2). The patient did not suffer any complication postoperatively.

Fig. 2. Intraoperative photographs depicting the intraoperative setup. Left: Overview of operating room setup. Fluoroscopy aids in the resection of suprasellar components of the lesion. The use of angled, longer endoscopes aids visualization of intracranial anatomy. Right: Closeup view of the operative portals demonstrating the location of the guide and speculum. One nostril is used for insertion of the endoscope and the other for operative instruments.

**DISCUSSION**

In 1912, Cushing[2] was the first to describe the transseptal transsphenoidal approach to the sella turcica. Guiot and Hardy[5-7] refined the technique and added intraoperative fluoroscopic guidance and the use of the surgical microscope. Since then, the approach has become the standard one for lesions of the sella and those extending to the midline in a suprasellar direction. The complications of the approach are well described and include septal perforation, septal deviation, tearing of the nares, persistent nasal discharge, recurrent nosebleeds, tooth analgesia, asymmetry of mucosal contour, dentalization of pulp of anterior teeth, sinusitis, and mucocele among others[1,10].

Currently endoscopic surgery is a safe and accepted method of sinus surgery[11,12,19]. Stankiewicz[17,18] has described an endoscopic approach to the sphenoidal sinus, and Gilain, et al.,[4] described the results of endoscopic surgery for inflammatory, infectious, and polypoid conditions of the sphenoid sinus. Building on this experience, otolaryngologists have reported pituitary tumor resection aided by endoscopic techniques:[9,15,23] a summary of these is provided in Table 1. The majority of these authors used endoscopic techniques as an adjunct to standard microscopic techniques. None of the reports appeared in the neurosurgical literature.
The safety of the approach described requires that the surgeon identify the posterior middle turbinate and the ostium of the sphenoidal sinus located in the sphenethmoidal recess between the septum and the superior turbinate. Care must be taken to identify normal intrasphenoidal anatomical landmarks[13] and to be cognizant of the positions of the optic nerves and carotid arteries at all times. Angled endoscopes allow the surgeon added panoramic visualization.

Entry to the sphenoid sinus can also be accomplished directly through the anterior wall of the sphenoid or via the ethmoidal bulla and sinus if the anatomy of the nasal cavity, previous nasal surgery, or other limitations hinder access to the sphenoidal ostium. The technique can also be performed transeptally, analogous to the microscopic approach.

Although we have performed the surgery though a single nostril, which acted as a portal for the endoscope and the surgical instruments, the dual-portal technique (Fig. 2 right) we have described allows superior maneuverability, flexibility, and efficiency over a single portal approach. The endoscopic approach should be individualized to the patient and assessed preoperatively by inspection of computerized tomography and magnetic resonance imaging studies and ultimately by endoscopic assessment at the time of operation. The endoscopic approach can also be used as an adjunct to the microscopic approach in inspecting the operative site for residual disease. Using the endoscope in this way can be particularly helpful in advancing surgeons along the learning curve in endoscopy.

Complications associated with endoscopic surgery for paranasal sinus disease may give clues as to some of the complications that might be encountered using this procedure for tumors of the sella turcica.
Although Stammberger[16] reported no serious complications in more than 2000 patients undergoing functional endoscopic surgery, Wigand and coworkers[20,21] reported CSF leaks in 2% of 1000 patients. Stankiewicz[17] reported an incidence of 3.9% of serious complications in 180 patients undergoing endoscopic procedures for ethmoidal sinus disease: two with massive hemorrhage, one with a CSF leak, one with temporary blindness, and five with orbital hematomas that developed intraoperatively. Schaefer, et al.,[14] reported that the most common complication following endoscopic sinus surgery for paranasal sinus disease was synchia between the middle turbinate and the lateral nasal wall in 6% of patients.

Despite the potential disadvantages, our experience with the approach has demonstrated the following advantages: 1) no sublabial or septal dissection provides quick, minimally invasive, and easy access to the sphenoid; 2) easy and widened maneuverability of the surgeon's view allows easy access to various paranasal sinus regions; 3) excellent illumination; 4) inserting the surgeon's "eye" directly adjacent to the pathology allows an unobstructed view of the operative field, a frequent problem with the restricted view afforded to standard microscopic approaches; 5) in the case of ethmoidal disease, it avoids the facial incision and potential scarring incurred by the transethmoidal approach; and 6) with the lessened mucosal dissection, mucociliary transport may be better preserved than traditional approaches. In addition to the benefits to patient and surgeon, from an educational perspective, the assistants, nursing staff, and students actually observe the same field as the surgeon, thus facilitating teaching and recording of events. We believe that the endoscopic approach will become a major addition to the treatment of lesions of the sella.

References


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