The Endoscopic Transsphenoidal Approach: Evolution and Personal Experience

Abordagem trans-esfenoidal endoscópica – evolução e experiência pessoal

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ABSTRACT

The transsphenoidal approach has been used for over a century to resect lesions of the sellar and parasellar regions. During the past decade, the sublabial, transseptal approach has been largely replaced by an endonasal approach, often with the very useful adjunct of the endoscope. This minimally invasive procedure for both the approach and the tumor resection improves patient comfort. The wide-angle, magnified visualization provided by the endoscope allows direct observation of critical surrounding structures of the central skull base and angled views for detecting tumor remnants not visualized with direct microscopic views. This report describes a 10-year experience with the endonasal, endoscopic approach to the sella turcica.

Keywords: Endoscopy, Pituitary adenoma, transsphenoidal surgery, minimally invasive surgery, sella turcica.

SUMÁRIO

A abordagem transesfenoidal tem sido utilizada há mais de um século para ressecar lesões selares e para –selares. Ao longo da década passada, a abordagem sublabial trans-septal tem sido substituída pela abordagem endonasal, geralmente com a utilização do endoscópio. Este procedimento minimamente invasivo tanto para a abordagem quanto para a ressecção do tumor aumenta o conforto do paciente. A visão ampliada e magnificada oferecida pelo endoscópio permite observação direta de estruturas críticas vizinhas da base do crânio e visões anguladas para detectar restos tumorais não observados pela visão direta do microscópio. Este trabalho descreve uma experiência de 10 anos com a abordagem endonasal endoscópica para a região da sela turca.

Palavras-chave: Endoscopia, adenomas de hipófise, cirurgia trans-esfenoidal, cirurgia minimamente invasiva, sela turca.
INTRODUCTION

The transsphenoidal approach to the pituitary was first performed by Schloffler in Vienna in 1907. The sublabial, transseptal version of this approach was initially popularized by Cushing, who abandoned the approach for a transcranial approach to pituitary lesions. Gerard Guiot in Paris continued to perform the transsphenoidal approach he had learned from Cushing, and taught it to Canadian Jules Hardy. The sublabial approach was then reintroduced to North America by Jules Hardy. Widespread and permanent adoption of the technique is credited to Laws, Wilson, and many others. By the 1970s, a sublabial approach to the sellar floor was generally employed for moderate-sized lesions of the region.

During the 1990s, several teams built upon the ideas of endoscopic pituitary surgery initially advanced by Guiot and Apuzzo. The use of the endoscope in transsphenoidal surgery gained momentum due to advances in optical technology and widespread adoption for sinus surgery by otolaryngologists. Jho, Cappabianca, and others advanced the concept of employing endoscopes to facilitate the transsphenoidal approach to the sellar floor. Several advantages were proposed. These included: minimal dissection with elimination of the need for a sublabial incision, panoramic view of the central skull base anatomy, with greater control of important structures, including carotid arteries and optic nerves, and improved patient comfort by eliminating the need for packing. Disadvantages included: loss of the depth perception and hands-free visualization provided by a binocular microscope, and the potentially problematic paramedian, rather than midline, approach provided by a completely endonasal route.

From 1996-1997, we performed all transsphenoidal surgery done via the traditional sublabial microscopic route, but added the use of the rigid 4mm, 18 cm sinus endoscope, and appropriate 0-degree, 30-degree and 70-degree lenses. This was done in conjunction with applied cadaver dissection of sinus anatomy. The advantages provided by adjunctive use of endoscope and microscope led us in 1998 to begin using a totally endoscopic endonasal approach to the sella. A combination of endoscopic and microscopic removal of the sellar and parasellar pathology has proven to be effective and safe. We report our 10-year experience with the endoscopic endonasal approach.

SURGICAL PROCEDURE

OPERATING ROOM ORGANIZATION AND PATIENT POSITION:

The patient is placed supine in a Mayfield headrest, with neck extended and head turned slightly to the right. The endoscopic equipment, including monitor, light source, video camera and recorder, are positioned above and behind the patient’s left shoulder. The frameless image guidance monitor is positioned alongside. Fluoroscopic visualization is helpful if frameless stereotaxy is not available. The surgeon stands at the patient’s right shoulder; the anesthesiologist and his or her equipment are on the patient’s left side. The nurse is at the patient’s head, with Mayo stand extending over patient’s left shoulder. A microscope is positioned close but out of the way, above the patient’s face.

The patient’s face and periumbilical region are prepped and draped. The nasal cavities are prepped with gauze pledgets of 5% chlorhexidine gluconate. Two cottonoids soaked in xylometazoline hydrochloride are gently and temporarily placed in each nare as nasal decongestants. The middle turbinate and septum are injected with diluted adrenaline (1:200,000). One dose of perioperative steroids is given to all but those patients with Cushing’s disease. Broad spectrum antibiotics are given pre- and 24 hours post-operatively.

APPROACH TO THE SELLA:

The endoscope (4mm diameter, 0-degree lens, 18cm length) is introduced into the chosen nostril. This is generally the right, although may be the left if the nasal septum is already significantly deviated to the right. The inferior and middle turbinates are identified, and the middle turbinate is compressed and mobilized laterally. This allows visualization of the superior turbinate, which is a guide to the sphenoid ostium. The superior turbinate is divided visually into thirds: the junction of the anterior two-thirds and posterior one-third is approximated. The natural ostium is just superior and medial to this point. The choana and sphenethmoid recess are followed superiorly to the sphenoid sinus ostium. This is normally located 1.5cm above the roof of the choana. The size and position of the sphenoid ostia are variable. Entry into the sphenoid sinus via the ostia may be facilitated by visualization of the contralateral ostium and/or use of image guidance (Fig.1). Gentle pressure in the superior aspect of sphenethmoid recess, between the superior turbinate and nasal septum is occasionally required to permit sinus entry. The mucosa surrounding the ostia is gently coagulated to avoid bleeding from septal branches of the sphenopa-
latine artery. These steps are performed bilaterally.

**Figure 1** - Intraoperative Image Guidance System. Note sphenoid sinus septa which inserts on right carotid canal.

The nasal septum is then separated from the sphenoid rostrum with a right-angled sharp Cottle dissector, and swung laterally. The entire anterior wall of the sphenoid sinus is visible. The anterior sphenotomy is performed by enlarging the two sphenoid sinus ostia with bone rongeurs in a medial and inferior direction. The sphenoid rostrum is completely removed, with bone punches or a microdrill. The anterior sphenoid wall is removed to the level of the planum sphenoidale superiorly and to the floor of the sphenoid sinus inferiorly. For macroadenomas, special care is taken to adequately remove the rostrum inferiorly, in order to permit suprasellar visualization for tumor removal. Meticulous hemostasis is achieved using bone wax and bipolar cautery (Fig.2).

**Figure 2** - Panoramic view of sphenoid sinus, demonstrating sellar floor and left carotid canal.

Next, one or more intrasphenoid septa are generally encountered. The pre-operative computerized tomographic scan in axial and coronal projections is reconciled to the endoscopic views. All septa are removed with small rongeurs, special care being taken when removing those which insert on the optic and/or carotid protruberances. (Fig. 3) A small speculum is placed in the nasal cavity. The sellar floor is examined. Any bony dehiscence already created by the presence of the tumor is developed along the epidural plane. An intact sellar floor is opened with a microdrill or osteotome. The epidural dissection is performed and complete removal of the sellar floor is achieved.

**Figure 3** - Axial CT bone window image, demonstrating erosion of bony carotid canal within the sphenoid sinus by tumor.

**REMOVAL OF THE LESION:**

The dura is coagulated in X-shaped fashion and incised; the dural leaflets pushed or coagulated to produce a rectangular opening. A specimen trap is used if cystic or hemorrhagic degeneration of the tumor has been noted on pre-operative images. Working first inferiorly, then laterally, and finally superiorly, the lesion is mobilized with curettes of various sizes and angles. Superior dissection performed too early will tend to deliver the patulous diaphragm sella prior to complete tumor removal and may lead to inadvertent penetration of the suprasellar cistern, causing CSF leak. Removal of sellar tumor may be performed under microscopic or endoscopic visualization. Once all sellar tumor has been removed, the 30-degree endoscope is used to explore the suprasellar space for additional tumor and verify that the suprasellar cistern has not been violated. Valsalva maneuver is performed to deliver additional tumor inferiorly and challenge the watertight nature of the dissection cavity. Venous bleeding from the cavernous sinus is best manged with small rolls of oxidized cellulose and gentle pressure. Meticulous hemostasis is achieved and confirmed with a 5-minute hypertensive challenge. This is achieved by
the anesthesiologist titrating small doses of neosynephrine to raise the systolic blood pressure to approximately 30mmHg above the patient’s normal pressure. This assures that hemo
tasis will remain secure with any post-operative coughing or straining that may occur.

SELLAR RECONSTRUCTION

Because the approach is a minimally invasive technique, there is generally not a large fragment of bone or cartilage to use for sellar reconstruction. A piece of autologous adipose tissue is generally harvested from the umbilicus. This small incision is more cosmetically acceptable and less painful than either the lower quadrant abdominal incision or a lateral thigh incision. A small adipose graft is placed at the sellar floor and held in place with fibrin sealant. In the case of an intraoperative CSF leak, the adipose is placed within the intradural space to prevent future leakage. This is held in place with fibrin sealant and a lumbar drained is placed post-operatively for 48 hours.

Irrigation and final hemostasis of the nasal mucosa is performed. The medial turbinate and nasal septum are medialized. (Fig.4). No nasal packing is used. A small triangular nasal drip pad is employed until drainage is minimal.

Figure 4 - Endoscopic view of closure after endonasal transsphenoidal approach: replacement of nasal septum in midline position and preserved superior turbinate.

The patient follow-up schedule is listed in Table 2.

The results of symptom control are listed in Table 3. Of 502 patients who presented with headache, all reported their headache was improved by 3 months after surgery. Among the 350 patients who presented with visual complaints and/or field defects, vision was preserved or improved in 344 (98%) and worse in 6 (2%).
Control of endocrinopathy with surgery alone was considerably more difficult. Results are listed in Table 4. Among 192 patients with prolactinomas, 120 (63%) experienced normalized prolactin levels and were normal, without need for dopamine agonist therapy, at most recent follow-up. For the 72 acromegalic patients, surgery was curative in 40 patients (56%) at most recent follow-up. The remaining patients were normalized with adjunctive radiosurgery. Three require ongoing additional suppressive medical therapy. Among the 30 patients with Cushing’s Disease, 20 (67%) were normal at last evaluation with surgery alone. The remainder were treated with adjunctive radiosurgery and steroid inhibitors. One patient was treated with adrenalectomy.

In addition, of the 264 patients with non-functional tumors, 14 (5.3%) have had recurrent, growing tumor on subsequent surveillance imaging. These patients were treated with a second debulking transsphenoidal resection, followed by radiosurgery.

### COMPLICATIONS

Complications are listed in Table 5. No carotid injuries occurred. There was one spontaneous subarachnoid hemorrhage from peri-operative rupture of a basilar artery aneurysm.

### DISCUSSION

A number of lessons can be derived from this 10-year experience. First, the endoscopic approach has been confirmed to be both a safe and effective means of removing tumors and other pathologies in this region. The concerns about the increased risk of a paramedian approach have been eliminated, as no injury to critical structures were encountered as a result of this approach. There were no carotid injuries, and the small number of patients in whom visual worsening occurred likely experienced this as a result of interruption in blood supply to the chiasm from tumor removal, not from any risk of the use of the endoscope in the approach. The complications encountered with this revised endonasal endoscopic technique are not in excess of those generally quoted for standard transsphenoidal surgery. (2,7) No return to surgery for repair of CSF leak occurred.

The efficacy of the approach has also been confirmed in this series. The recurrence rate is compatible with those reported for standard sublabial resection of such tumors. The recurrence rate for secretory tumors remains undesirably high. This appears to be due to local invasion of the dura and cavernous sinuses, rendering complete removal of such tumors impossible without unacceptable neurologic deficit. For the foreseeable future, adjunctive therapy with antagonist medications and/or radiotherapy will be the norm for such lesions.

### CONCLUSION

The goal of this report is to describe the technique and results for surgery of the sellar region using an endonasal endoscopic approach. This 10-year experience demonstrates efficacy and safety which is comparable to the standard sublabial approach. Given the readily observed improvement in patient comfort for this minimally invasive technique over that experienced by patients undergoing the sublabial approach, the endoscopic approach and resection of sellar lesions may become the procedure of choice for such lesions.
REFERENCES


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