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CASE REPORT

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## Pituitary Surgery Using a Minimally Invasive Trans-Nasal Endoscopic Approach and 3-D Imaging Guidance: A New Technique

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CASE REPORT

### ABSTRACT

This report describes an innovative surgical technique for pituitary surgery, using a minimally invasive approach, which combines frameless stereotactic 3-D guidance (neuro-navigation) and a trans-nasal endoscopic approach. The procedure takes less time than conventional pituitary surgery and is better tolerated by the patient. The author has developed expertise in endoscopic neurosurgery over the years (including endoscopic removal of colloid cyst of the 3<sup>rd</sup> ventricle, 3<sup>rd</sup> ventriculostomy for obstructive hydrocephalus, removal of intraventricular tumors, etc.) and has applied with success this technique to the surgical removal of pituitary tumors in El Paso at Thomason Hospital.

### INTRODUCTION

Pituitary tumors are relatively common, representing about 10 to 15% of all tumors operated in neurosurgery. Some of them present with hyper-secretion, such as the classical amenorrhea-galactorrhea syndrome of prolactinoma, but a majority of pituitary tumors are non-secreting or non-functional. Those non-secreting tumors usually present with a combination of symptoms and signs that includes chiasmatic compression syndrome, cranial nerve dysfunction and progressive loss of pituitary function. For some of the secreting tumors (non-responding to hormonal manipulation), and most of the non-secreting tumors, surgery is the best option. The classical sub-labial approach for pituitary surgery, including the removal of tumors or other space-occupying lesions involving the pituitary sella, is very well described and widely used<sup>1,2</sup>. The classical approach involves the use of a large sub-labial intra-buccal incision, removal of a significant amount of bone at the base of the nasal opening, and a relatively extensive dissection of the midline structures of the nose including cartilage and mucosa. Most of the time, the neurosurgeon is assisted by an Ear Nose and Throat surgeon for this classical approach. This approach is relatively benign, but is not without its own complications, because of the dissection required for establishing this wide exposure. Complications include septum perforation, nose deformity (by removing too much septum cartilage and/or bone), septum hematomas and infection<sup>1,2</sup>.

Endoscopic surgery was introduced in neurosurgery more than 20 years ago and was primarily used for removal, puncture or biopsy of intraventricular lesions and for the treatment of hydrocephalus<sup>3,4,5</sup>. However, neurosurgeons later realized that this technique could be applied to pituitary surgery, and soon the advantages of it became obvious<sup>6</sup>. The endoscopic approach

can be done intra-nasal instead of sub-labial intra-buccal, avoiding any extensive dissection or incision. The classical midline approach is a 'straight-line' visualization technique, and is mostly a 'blind' technique for the removal of any lesion lateral to the midline, since anything lateral of the midline cannot be seen directly. This visualization problem can be eliminated using endoscopes with angulated lenses, which allow seeing laterally. The technique requires a smaller surgical corridor, and all the complications from the classical are minimized<sup>7,8,9</sup>. This technique respects all the criteria for being called a minimally invasive procedure (smaller incision, smaller surgical path, decreased total operative time, better tolerated by the patient).

### Technique

The patient is admitted the morning of the surgery. An MRI is obtained just before surgery (or out-patient the day before admission), for 3-D imaging and intra-operative guidance. This 3-D imaging is used during the surgery for real-time guidance, avoiding the need for any X-ray fluoroscopic localization. The surgery is done under general anesthesia with the patient supine (Figure 1). A unilateral intra-nasal approach is used, which requires only a very short sub-mucosal incision inside the nose. The dissection progresses until the sphenoid sinus is reached. The anterior part of the sphenoid sinus is opened like with the classical approach, but a smaller opening is needed. The endoscope is used for visualization and the instruments used for removal of the pituitary lesion are basically the same as for a classical approach (Figure 1). Closure involves only the insertion of a few sutures to close the mucosal flap, and a nasal packing that is kept overnight. The patient is allowed to drink and eat right after surgery. For large tumors, the patient can be discharged the next day unless there is a temporary endocrine disturbance preventing doing so (ex. diabetes insipidus) or a CSF-leak. For small tumor (ex. Micro adenoma) most patients can be discharged the same day (outpatient procedure).

### Discussion

There are multiple advantages by using this approach for removal of pituitary tumors. Complications directly related to the approach are less frequent compared with classical approach, the operative time can be decreased and the procedure is better tolerated<sup>7,8,9</sup>. The only limitations of this approach are related to the training and expertise required and a steep learning curve. Initially, the total operative time can be slightly longer compared with a classical approach. With the increasing experience of the surgeon, the total time for doing the procedure should become

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shorter, most of the time being saved on the approach time itself.

Complications arising from the pituitary surgery per se using this approach are the same (diabetes insipidus, CSF leak) and occur with the same incidence and are mostly related to the size and invasiveness of the tumor and not related to the approach used. Whether or not this approach is better for maximizing tumor resection (by allowing visualization at some angle) is still debated in the literature.

This minimally invasive procedure has not yet replaced the classical open approach for pituitary surgery, and did not achieve wide usage. This is primarily because there is specialized equipment needed and additional training. Minimally invasive approaches are common in all branches of surgery for benefit of patients and much higher demand for surgeons. We have that expertise and few patients have already benefited with this technique. We believe that the actual trend toward minimally invasive approaches in neurosurgery will continue to expand, becoming part of every training program and that eventually minimally invasive endoscopic surgery will be the new standard for pituitary surgery.

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**Figure 1.** Intra operative setup for endoscopic transnasal minimally invasive pituitary surgery. The surgeon is manipulating the surgical instruments and endoscope, inserted in the patient's nostril, while looking on the monitor connected to the endoscope (right side of picture). 3-D Real-time guidance is provided by the neuro-navigation system (background, center of picture).

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