Endoscopic Versus Microscopic Transsphenoidal Approach for Pituitary Adenomas: Comparison of Outcomes During the Transition of Methods of a Single Surgeon

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■ OBJECTIVE: **The transition from microscopic to fully endoscopic transsphenoidal surgery requires a surgeon to assess how the change in technique will affect the extent of tumor resection (EOR), outcomes, and complications. We compared a single surgeon's experience transitioning from one technique to the other and examined the operative outcomes and EOR between microscopic versus endoscopic transsphenoidal surgery.**

■ METHODS: **Retrospective data analysis of adult patients who were treated surgically for a pituitary adenoma between August 2005 and May 2015 by a single neurosurgeon, who was originally trained and practiced in the microscopic transsphenoidal approach. Patient demographics, perioperative conditions, tumor characteristics, operative times, volumetric EOR, postoperative outcome, and the endoscopic learning curve were evaluated.**

■ RESULTS: **One hundred and nine patients underwent microscopic transsphenoidal surgery and 275 patients underwent a fully endoscopic approach. The patient characteristics were similar in the 2 groups. Operative room time was significantly shorter in the endoscopic group than in the microscopic group (180.2 vs. 215.6 minutes; $P < 0.001$). The endoscopic and microscopic groups had similar volumetric EOR (85.1% vs. 82.8%; $P = 0.371$) as well as residual tumor volume (1.06 cm^3 vs. 1.15 cm^3; $P = 0.765$). The mean length of hospital stay was 2.4 days in the endoscopic group and 3.2 days in the microscopic group ($P = 0.03$).**

■ CONCLUSIONS: **During the transition from the microscopic to the endoscopic approach, similar surgical outcomes and EOR were achieved in the 2 cohorts. In our experience, the endoscopic approach offers the advantage of shorter operative times and lengths of hospital stays after the surgeon has developed more experience with the technique.**

INTRODUCTION

The endonasal transsphenoidal surgical approach to the pituitary was first described coincidentally by Harvey Cushing and Oskar Hirsch in 1910.[1,2] Cushing later abandoned the approach when he was unable to achieve good light penetration into the narrow corridor, which caused poor tumor resections and high complication rates.[1] In 1962, Jules Hardy introduced the operative microscope, which helped improve the magnification and illumination of the operative field.[3] The operative microscope soon became the standard for transsphenoidal pituitary tumor resections. The mid 1990s saw the emergence of rigid endoscopes for resection of pituitary tumors.[4-6] Shortly after the introduction of rigid endoscopes, several institutions began to transition to endoscopic techniques because of the improved visualization provided by the wider and angled views of the endoscope.[3] Proponents of the endoscopic approach believe that the improved visualization and additional lighting allow for better differentiation between tumor and normal gland, which may improve preservation of pituitary function and increase extent of tumor resection (EOR).[7,8]

Numerous studies have compared the endoscopic versus microscopic surgical approaches at the institutional level; however, when an individual surgeon decides to transition from the microscopic to endoscopic approach, little literature is available about how this transition can affect a surgeon's operating room

Key words
- Endoscopic surgery
- Microsurgery
- Outcome
- Pituitary adenoma
- Transsphenoidal surgery

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
EOR: Extent of resection
LOS: Length of stay

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times, EOR, and operative outcomes.[9-12] We describe a large single-surgeon experience of converting from a microscopic approach to an entirely endoscopic approach for the resection of pituitary adenomas and evaluate the perioperative outcomes, EOR, and learning curve during this transition.

METHODS

Patient Population

A retrospective analysis was conducted on 384 patients who underwent endonasal transsphenoidal surgery for a pituitary adenoma between August 2005 and May 2015. An endoscopic surgical approach was used on 275 patients (between 2007 and 2015), and a microscopic surgical approach was used on 109 patients (between 2005 and 2013). Patients were ≥18 years old with a pituitary adenoma who underwent a transsphenoidal tumor resection at a single institution by a single surgeon. All patients underwent a preoperative radiologic, neurologic, endocrinologic, and ophthalmologic assessment. Endoscopic surgery was performed as fully endoscopic uninostril transsphenoidal surgery and the microscopic surgery was performed as direct uninostril microscopic surgery using a nasal speculum without the use of a supplemental endoscope. Patient characteristics did not influence surgical approach selection.

Surgical Procedure

The senior neurosurgeon was trained to perform transsphenoidal surgery using the microscopic technique and had 3 years of experience using this approach before transitioning to the endoscopic approach. Neuronavigation was used in each case. Intraoperative or postoperative lumbar drainage was not routinely used.

Microscopic Group. The microscopic uninostril technique was used with a nasal speculum. The tumor was removed using suction, pituitary rongeurs, and various angled ring curettes. Once tumor resection was complete, the surgical field was inspected for cerebrospinal fluid (CSF) leak. The sellar space was patched with an autologous fat graft, from the abdomen, and a hemostatic cellulose polymer (Surgicel [Ethicon]) with dural sealant (DuraSeal [Covidien]) to reconstruct the sellar floor.

Endoscopic Group. An endoscopic endonasal technique was used using a 3-hand technique. A single nostril approach was taken with 1 operator. The middle turbinate was visualized and lateralized (kept intact), and the choana and sphenoid ostia were identified. The posterior nasal septum was injected with 0.5% marcaine with 1:200,000 epinephrine. Monopolar cautery was used to dissect the posterior nasal mucosa and to create a mucosal vascularized nasoseptal flap when needed. The septum was lateralized to the contralateral side to expose the vomer and visualize the sphenoid ostia on each side. A sphenoidotomy and removal of the sphenoid septa were created using a high-speed drill with a 2-mm diamond bit. The drill was also used to open the anterior sellar floor. A linear incision was used to incise the dura using an 11-blade scalpel. At this point, the surgical assistant held the endoscope while the surgeon removed the tumor using various angled curettes, pituitary rongeurs, and suction. After resection of the lesion, the resection cavity was inspected using a 30° and 45° endoscope to visualize compartments outside the direct line of view. The sellar space was patched with an autologous fat graft, from the abdomen, and a hemostatic cellulose polymer (Surgicel) with dural sealant (DuraSeal) to reconstruct the sellar floor (**Figure 1**). If significant intraoperative CSF was observed during the case, the nasoseptal flap was used with dural sealant to reinforce the skull base.

If a CSF leak was appreciated, then the nasal septal flap was elevated and used to reconstruct the sellar floor with dural sealant (DuraSeal). No nasal splints or packs were placed postoperatively. The operative time was the time that the patient entered the operating room until the time that the patient departed the room based on the anesthesia record.

Postoperative Care

Patients were managed postoperatively by the neurosurgery team with assistance from the endocrinology team. They were observed and managed for possible diabetes insipidus and to determine whether to continue or discontinue perioperative hydrocortisone supplement. Patients were followed up postoperatively at 1 month, 6 months, and then annually with neurosurgery and endocrinology and received an assessment of pituitary function and hormonal replacement therapy. Patients who showed visual compromise before surgery were also assessed by a neuro-ophthalmologist.

Hormonal cures were considered postoperative normalization of pituitary oversecretion at the 6-month follow-up.[13] Tumor recurrence was considered regrowth of the tumor after a total resection, and tumor progression was considered increased growth of residual tumor seen on postoperative MRI.

EOR Analysis

Preoperative MRI scans performed 1 day before or on the day of surgery (used for neuronavigation) and a postoperative MRI scan performed 48 hours after surgery were used for analysis. A volumetric analysis using the noncontrast and postcontrast T1 coronal sequences from a 1.5-T MRI scanner were used to determine EOR. The OsiriX software (Pixmeo) was used to calculate the area of each 1.5-mm to 3-mm coronal cut and the tumor volume was calculated based on the sum of the coronal sections, as we had previously described, by a clinician who was blinded to the surgical technique used.[14,15] EOR was calculated using the formula (preoperative − postoperative tumor volume)/preoperative tumor volume.

Statistical Analysis

Univariate statistics were performed to generate descriptive statistics, which were reported as number of subjects and percent for categorical variables, mean, and standard deviations for continuous parametric variables. Parametric comparisons between 2 groups were performed using the 2-sample t test and nonparametric comparisons performed using the Welch test. Categorical comparisons between the 2 groups (microscopic vs. endoscopic) were performed using a Pearson χ^2 test. The significance of differences was evaluated according to a type I error-rate threshold of $\alpha = 0.05$. Kaplan-Meier curves were generated, stratified by the 2 groups (microscopic vs. endoscopic). A hazard ratio test was