Transition From Microscopic to Endoscopic Transsphenoidal Surgery for Nonfunctional Pituitary Adenomas

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■ OBJECTIVE: **At our institution, a total of 320 patients were operated on between 2000 and 2010 for a newly diagnosed pituitary adenoma. In an attempt to improve quality of tumor resection, the transsphenoidal microscopic technique was replaced by the endoscopic technique in June 2008. This retrospective single center study compares the outcomes after microscopic (n = 144) and endoscopic (n = 41) tumor surgery of all patients operated on for a nonfunctional pituitary adenoma.**

■ METHODS: **Tumor size and location, Knosp grade, prevalence of anterior hypopituitarism, diabetes insipidus, visual acuity/fields, complication rates, and operation time were compared between the groups.**

■ RESULTS: **At the 3-month follow-up, hypopituitarism had improved in 7% of patients in the microscopic group and in 9% in the endoscopic group, and had further impaired in 13% and 9%, respectively. At the 3-month follow-up magnetic resonance imaging, a total tumor removal was achieved in 45% versus 56% of patients, respectively (*P* = not significant [NS]). Visual fields had normalized or improved in 90% versus 88% of patients, respectively (*P* = NS). Postoperative cerebrospinal fluid leak occurred in 3.5% versus 2.4% (*P* = NS), and diabetes insipidus (transient or permanent) in 7.6% versus 4.9% (*P* = NS) of cases, respectively. Larger tumor size (*P* < 0.0005) and endoscopic technique (*P* = 0.03) were independent predictors of increased mean operative time.**

■ CONCLUSIONS: **Initial results with the endoscopic technique were statistically similar to those achieved with the microscopic technique. However, there was a trend toward improved outcomes and fewer complications in the endoscopic group.**

INTRODUCTION

The most common treatment for nonfunctional pituitary adenomas (NFPAs) is gross total resection, which is usually best accomplished with the transsphenoidal approach. However, enormous variation exists in the reported rates of gross total removal of NFPAs, ranging from 27%–83% (9, 12, 14, 21, 29). Our belief that improved visualization of the tumor perimeter would enhance the quality of resection encouraged us to replace the microscopic technique with the endoscopic technique, which has been exclusively applied thereafter. To clarify the effects of this transitional period, we conducted a systematic retrospective study comparing the outcome of the microscopic versus endoscopic surgery for all NFPAs operated on at our center from 2000 to 2010.

METHODS

Patients

Inclusion Criteria. During an 11-year period (from 2000 to 2010), 330 newly diagnosed patients with pituitary adenoma were operated on at our institution. Our center serves a population of 1.8 million people. This population-based study included 185 consecutive patients who had NFPAs. In June 2008, the transsphenoidal technique was modified, and the microscope was replaced by the endoscope, which was then used exclusively. This time-point divided patients into 2 groups: the microscopic group was operated on during the first 101 months of the study and the

Key words
- Endoscopy
- Nonfunctioning pituitary adenoma
- Transsphenoidal surgery

Abbreviations and Acronyms
CSF: Cerebrospinal fluid
MRI: Magnetic resonance imaging
NFPA: Nonfunctional pituitary adenoma

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endoscopic group, during the last 31 months of the study period. Data were collected from medical records and imaging studies in a retrospective fashion. The study protocol was approved by the institutional review board. Informed written consent to collect follow-up data from other hospitals was obtained from all patients. Four patients were lost to follow-up. Data collection occurred between January 2012 and June 2013.

Exclusion Criteria. Patients having a hormonally active adenoma (n = 134) or a pituitary carcinoma (n = 2), patients with a history of previous pituitary surgery (n = 34), or patients undergoing a craniotomy (n = 2) were excluded from the study.

Surgical Procedure

General Considerations. All operations were carried out by experienced neurosurgeons using a 2-armed technique. An assistant surgeon was involved occasionally. Fluoroscopy was regularly used during the initial steps of the microscopic approach for correct placement of the nasal retractor. Neuronavigation was not routinely used in either group.

The technique and the instruments applied for tumor removal were uniform in both groups. An ultrasonic aspirator was not used. Intraoperative or postoperative lumbar drainage was not routinely used.

Microscopic Group. The microscopic transseptal technique was used. The tumor was removed using suction, ring curettes, and pituitary rongeurs of appropriate sizes and angles, starting inferolaterally and working posteriorly, leaving the anterosuperior part of the tumor untouched as long as possible. Once the removal was completed, cerebrospinal fluid (CSF) leakage was looked for and if necessary confirmed with the Valsalva maneuver. If CSF leakage was detected, an autologous fascia-fat graft (harvested from the thigh) and a piece of bony septum (vomer) were inserted in the sellar floor defect.

Endoscopic Group. The endoscopic endonasal technique was used. The endoscope was fixed with an adjustable holder in a superior position, mildly stretching the nostril upward to allow maximum space for the instruments passing below. When in doubt, the position of the carotid artery was confirmed with micro-Doppler before cruciate incision of the dura. From this point, the procedure continued in the same fashion as in the microscopic group, until no more tumor was seen. To finish the tumor removal, 30° and 45° optics were introduced, if necessary, to visualize possible tumor remnant in any of the compartments beyond the direct line of view. Maneuvering of the angled endoscope was done freehand, usually with a curved-tip suction tube in the other hand. If necessary/convenient, the angled endoscope was fixed in position to work with both hands (2 instruments). Reconstruction of the sellar floor followed the same principles as in the microscopic group.

Postoperative Care and Follow-up

Patients with suspected postoperative CSF rhinorrhea were primarily managed with a lumbar drain. On the second postoperative day the patient—as part of our multidisciplinary University Hospital strategy—was transferred to the Endocrine Unit for an additional 2–3 days. There, they were observed and evaluated for continuation or discontinuation of perioperative hydrocortisone replacement therapy, managed for possible diabetes insipidus, and discharged home on the fifth or sixth postoperative day. This invariable length of hospital stay allowed for optimal evaluation and management of the patient's hormone and fluid balance. Furthermore, a 3-month follow-up visit at the Endocrine Outpatient Clinic was planned for all patients. This included evaluation of the neuropathologist's report, assessment of pituitary function, hormone replacement therapy, and a follow-up magnetic resonance imaging (MRI) scan to evaluate the operative result. Patients demonstrating impaired visual fields/visual acuity before surgery were re-examined by a neuro-ophthalmologist. Thereafter, follow-up visits at the Endocrine Outpatient Clinic occurred annually.

Neuroradiology

The minimum imaging protocol consisted of sagittal and coronal T_1-weighted, thin-sliced sequences, with and without contrast media, using a 1.5-Tesla MRI scanner. If a patient had a cardiac pacemaker, the scanning was done using computerized tomography with 3-dimensional reconstruction. The tumor was measured in 3 dimensions (A: height, B: width, C: length), and the volume was calculated (ABC/2) independently by an experienced neuroradiologist and a neurosurgeon. The lateral extension was assessed by using the Knosp classification (18), where grades 0 and 1 refer to a noninvasive tumor and grades 2–4, to increasing invasion of the cavernous sinus.

Postoperative MRI scanning was performed at 3 and 12 months, and thereafter at 1- to 3-year intervals, based on clinical judgment. The extent of resection (total or subtotal) was evaluated using the 3-month postoperative scan. Possible tumor remnant was measured in all 3 dimensions, and the volume and residual percentage calculated. If necessary, the postoperative artifacts (grafting, scarring) were excluded by assessing the follow-up scan at 12 months. In case of uncertainty, the grading was done in favor of an existing residual. The center point of the tumor residual was classified as intrasellar, lateral, suprasellar, both lateral and suprasellar, or infrasellar/clival. We defined a recurrent tumor as a new tumor growth in cases with initial gross total resection (no tumor seen at 3-month postoperative scan). Cases with a postoperative residual tumor were classified as progressive, stable, or shrunken during later follow-up.

Endocrine Assessment

Preoperative pituitary function (hypopituitarism and hyperpituitarism) was assessed in all patients using in-house assays at Helsinki University Hospital Laboratory and clinical evaluation at the Division of Endocrinology. Thyroid and adrenal axes were evaluated and measurements of fluid balance were performed immediately after surgery, and more thorough hormonal evaluation, including secondary hypogonadism, was performed at the later follow-up visits (3 months, 12 months, and yearly thereafter). When growth hormone deficiency was suspected, the growth hormone-releasing hormone-arginine test was performed in addition to growth hormone and insulin-like growth factor 1 measurements, as this is a prerequisite for possible reimbursement of growth hormone therapy treatment in Finland.

Ophthalmologic Assessment

Visual acuity and visual fields were assessed by a neuro-ophthalmologist preoperatively. This included all patients with