



Pure Endoscopic Endonasal Transsphenoidal Approach for Nonfunctioning Pituitary Adenomas in the Elderly: Surgical Outcomes and Complications in 158 Patients

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■ **OBJECTIVE:** To evaluate the safety and efficacy of the endoscopic endonasal transsphenoidal approach (EETA) for nonfunctioning pituitary adenoma (NFPA) in the elderly population.

■ **METHODS:** We performed a retrospective review of operative cases over a 7-year period, in which 158 elderly patients (age 65 years and older) who underwent a pure EETA to remove a pituitary adenoma were identified and compared with a series of 155 younger patients (age 40–55 years) who underwent the same procedure during the same period. The medical charts of the patients were reviewed to collect demographic information, such as age, sex, clinical symptoms, tumor size, the extent of tumor resection, clinical outcome, and complications.

■ **RESULTS:** In the elderly group, total resection was achieved in 120 patients (75.9%), and 124 patients (78.5%) achieved significant postsurgical visual remission. In the younger group, total resection was achieved in 119 patients (76.8%), with 126 patients (81.2%) achieving significant postsurgical visual remission. Regarding surgical complications in the elderly group, transient diabetes insipidus occurred postoperatively in 28 (17.8%) patients, and permanent diabetes insipidus occurred in 7 (4.4%) patients. Six (6.4%) patients experienced postoperative cerebrospinal fluid leakage, and new developments of anterior hypopituitarism occurred in 15 (9.5%) cases. In the younger group, 21 (13.6%) patients developed transient diabetes insipidus postoperatively, and 5 (3.2%) patients experienced permanent diabetes insipidus. Six (3.9%) patients reported postoperative cerebrospinal fluid leaks, and 13

(8.4%) patients developed a new anterior hypopituitarism. There were no cases of either carotid artery injury or death in either group. During the follow-up (mean, 32 months), 11 (6.9%) patients experienced tumor recurrence in the elderly group compared with 24 (15.5%) patients in the younger group. Of the 15 elderly patients who developed new hypopituitarism, 13 (86.7%) recovered without hormone replacement; accordingly, the rate of hypopituitarism remission was 84.6% in the younger patients.

■ **CONCLUSIONS:** NFPAs in the elderly can be resected via a pure endoscopic technique with low morbidity and mortality.

INTRODUCTION

Nonfunctioning pituitary adenoma (NFPA) is a common type of sellar tumor that manifests predominantly in an older adult population (i.e., aged 40–80 years).¹ Visual acuity and visual field impairment are the most frequent presentations of NFPAs in the elderly.^{1,2} These visual deteriorations result from compression of the optic nerves and chiasm due to expansion of the tumor. Accordingly, surgical resection of the tumor was thought to be the first-choice treatment of NFPAs. Over the last 2 decades, the endoscopic endonasal transsphenoidal approach (EETA) has been increasingly adopted by neurosurgeons and has become popular in many centers.^{3–6} The EETA provides better visualization, decreased invasiveness, fewer complications, quicker recovery, and overall improved results compared with the traditional transsphenoidal approach.⁶ As the aging population continues to increase, the number of elderly

Key words

- Complications
- Elderly patients
- Endoscopic endonasal transsphenoidal approach
- Nonfunctioning pituitary adenoma
- Surgical outcome

Abbreviations and Acronyms

- CSF:** Cerebrospinal fluid
DI: Diabetes insipidus
EETA: Endonasal endoscopic transsphenoidal approach
NFPA: Nonfunctioning pituitary adenoma
PNSF: Pedicled nasoseptal flap

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patients with pituitary adenoma continues to increase. Based on recent studies,^{7–12} we have defined the elderly population as age ≥ 65 years. Currently, there are few reports focusing on complications related to the EETA for elderly patients with NFPAs.¹³ In this article, we present our experience with the removal of nonfunctioning pituitary adenomas from patients aged 65 years or older and discuss the surgical complications related to this approach.

METHODS

Study Design

We conducted a retrospective chart analysis to identify elderly patients (age 65 years and older) who underwent a pure EETA for the resection of a pituitary adenoma. One hundred fifty-eight patients who were admitted to Qilu Hospital at Shandong University between January 2008 and December 2014 met the inclusion criteria. Because our study focused on elderly patients undergoing a pure EETA, patients who underwent either a transcranial approach or a craniotomy assisted by an EETA were excluded from this study. In addition, patients with significant comorbidities such as an American Society of Anesthesiologists score ≥ 4 were excluded from the study. The elderly patients were compared with a control group of younger patients aged between 40 and 55 years who underwent the same approach for the resection of a pituitary adenoma by the same surgical team. The charts were reviewed for age, sex, clinical symptoms, tumor size, the extent of tumor resection, clinical outcome, surgical complications, systemic complications, and follow-up. The protocol for this study was reviewed and approved by the Ethics Committee of Qilu Hospital of Shandong University (IRB: KYLL-2013-010).

Statistical Methods

Statistical comparisons between the 2 groups were made using χ^2 analysis for the categorical variables and Student's *t* test for the continuous variables. Fisher's exact test was applied if there were fewer than 5 values per cell. Two-tailed tests were performed for each scenario and were considered to be statistically significant if the *P* value was < 0.05 . Data were analyzed using SPSS 19.0 (IBM Corp, Armonk, New York, USA).

Endoscopic Technique

Under general anesthesia with orotracheal intubation, the patient was placed in the supine position with slight rotation of the head toward the right shoulder to allow for easy surgical access. We did not routinely use Mayfield-Kees rigid 3-pin skeletal head fixation unless neuronavigation was required. Typically, the right lateral thigh was prepared for harvest of the fascia lata, fat, or muscle to repair the skull base as needed. The nasal mucous membranes were decongested with injection of 1% lidocaine with epinephrine (1:100,000 dilution).

The procedure was performed with a 0-degree endoscope, 4 mm in diameter and 18 cm in length. The endoscope was routinely inserted into the right nostril. The middle turbinates were lateralized to increase the surgical corridor, and the endoscope was then directed upward approximately 1.5 cm above the posterior nasal apertures to access the sphenoid ostium, a key anatomic landmark. A wide sphenoidotomy and posterior septectomy were

performed. After removal of the sphenoid sinus septations, the sellar floor was opened with a high-speed microdrill. In cases where the sphenoid sinus was filled with tumor, drilling of the floor of the sella was unnecessary.

After a cruciate dural opening, the tumor in the sella turcica was removed with either a curette or by suction. The suprasellar tumor often dropped down into view due to cerebral spinal fluid (CSF) pulsations and was easily removed. After resection of the central portion of the tumor with the 0-degree endoscope, a 30-degree endoscope was used to detect and remove any residual tumor. The surgical cavity was filled with Gelfoam. If an intraoperative CSF leak was suspected or confirmed, reconstruction of the skull base was performed using the following technique: an autologous fat or fascia lata graft was placed within the dural defect as an inlay graft, a synthetic dural graft was used as an overlay graft, and a small amount of muscle pulp was placed in between the inlayer and overlayer to enhance graft adherence. Fibrin glue was applied over the synthetic dura, the sphenoid sinus was filled with Gelfoam, and the nasal cavity was packed with pledgets. A vascularized pedicled nasoseptal flap (PNSF) was used as previously described¹⁴ if CSF was confirmed during the surgery. All patients received intraoperative prophylaxis of a third-generation cephalosporin.

Postoperative Management

Postoperatively, a third-generation cephalosporin was continued for approximately 7 days. Urine volume as well as fluid intake and output were routinely monitored. All patients with a functioning adenoma were evaluated endocrinologically to observe hormone function after surgery. Hormone replacement therapy was applied in cases with insufficient postoperative hormones levels. Magnetic resonance imaging was routinely performed 1–3 days postoperatively and at 3 months to evaluate the extent of tumor resection (total resection, no evidence of residual tumor; subtotal resection, residual tumor $< 20\%$; partial resection, residual tumor $< 50\%$; and insufficient resection, residual tumor $> 50\%$).¹⁵ Nasal packing was generally removed endoscopically 1–3 days after surgery. Patients were instructed to rest with their head elevated approximately 15° and to avoid any activity that might raise their intracranial pressure such as straining or nose blowing. Patients who had evidence of postoperative CSF leakage were managed with lumbar drainage and bedrest for 1 week. Especially for the elderly patients, active movements or passive movements of the lower limbs were performed to prevent venous thromboembolism, and chest physiotherapy and pulmonary hygiene were performed to avoid pulmonary complications. In cases with postoperative diabetes insipidus (DI), hypophysin was injected subcutaneously to control the symptoms for the first 3 days. If that treatment was insufficient, desmopressin was administered daily, as we do not typically use controlled-release vasopressin tannate because of the inconvenience for the patient, and difficulty with controlling its effects. During the follow-up period, a routine magnetic resonance scan was used as a primary method of monitoring. Based on the imaging, discovery of either a new pituitary adenoma or the regrowth of residual tumor more than 20% in volume was defined as a recurrence of NFPA.

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